RADIO SETUP SECRETS of an AEROBATIC CHAMP p. 48 »

FEBRUARY 2004

MODEL Airplane NEWS

MODEL AIRPLANE NEWS 75th ANNIVERSARY 1929-2004

BEST in SHOW

U.S. SCALE MASTERS

Fly this .60-size ARF
Hangar 9 Texan

Convert a Big Warbird to Electric *p. 128*

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ZENOAH G-26

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MODEL Airplane NEWS

FEBRUARY 2004, VOLUME 132, NUMBER 2

FEATURES

FLIGHT TESTS

CONSTRUCTION

ON THE COVER: the colorful Hangar 9 AT-6 Texan ARF is a great .60-size sport-scale choice for those fliers who want a quick-building classic (photo by Deron Neblett). ON THIS PAGE: a beautiful shot of Glenn Reilly's FW-190 coming in for a landing at the 2003 U.S. Scale Masters Championships. Built from Vailly Aviation plans, the impressive Butcher Bird has a 91-inch span and is powered by a Quadra 65 gas engine (photo by Gerry Yarrish).

COLUMNS

DEPARTMENTS

EDITORIAL

BY DEBRA CLEGHORN

Scale showdown

Of all the RC plane events held in the U.S., only one can crown a scale national champion: the U.S. Scale Masters. Every year, thousands of modelers compete at local and regional events in the U.S., Canada and Brazil to earn the right to fly at this prestigious event, so you know that the model planes that fly here are the best of the best. This year, senior tech editor Gerry Yarrish traveled to Dayton, OH, camera in hand, for the 24th annual rendition of the Scale Masters to bring back photos of these topnotch scale models. See his article on page 36 to find out which planes claimed the glory in 2003.

WIDE WORLD OF GLUES

White glue, epoxy, cyanoacrylate ... we use these adhesives every day for building planes and in other household projects, but how much do you really know about them? Which are best to use for particular projects? Which are stronger than others? And don't forget specialty glues, such as those that are flexible when they dry and those that make good fillers. The *Model Airplane News* crew, led by associate West Coast editor John Reid, researched this sticky subject, and we were surprised by some of what we learned. See "The ABCs of Adhesives" for an in-depth look at all types of glues, including tips and techniques for using them right.

SETUP FOR AEROBATICS

World aerobatics champion pilot Quique Somenzini continues his flight techniques series with a closer look at radio setup; specifically, managing your radio programming rates, exponential and mixing settings within flight modes. When you combine like maneuvers into these modes, you can simply flip a switch to accurately adjust your settings. If you're serious about aerobatics, check out Quique's article "Freestyle Aerobatics"; it's one that you'll definitely want to bookmark!

IN THE WORKSHOP

Our featured construction article this month is David Johnson's sport-scale Fokker D-VII. This .25-size model is extremely easy to build and uses traditional construction techniques, so you and a friend can build two in no time. Why build two? Because this 43-inch-span plane is an ideal dogfighter! See David's "WW I Combat Guidelines" sidebar for some basic rules and regs that he and his flying buddies have used for 1/12-scale RC combat.

While you're surfing the Web this winter, stop by the *Model Airplane News* site at modelairplanenews.com. You'll find article reprints, video clips, a full listing of (and online ordering for) all our available construction plans and books and a bulletin board where you can talk with modelers around the world. See you there!

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WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA; email man@airage.com. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.

HAPPY 75TH

I read that *Model Airplane News* is celebrating its 75th birthday, and I just want to tell you how great your January 2004 issue is. Reading about many of the old articles brought back fond memories of when I started flying model airplanes with my father in Van Cortland Park in New York City. Back then (the early '60s), we flew a collection of old free-flight models and longed one day to control a plane by radio. I want to thank Nick Ziroli, Dave Gierke and Bob Aberle for their nostalgic editorial. Thanks for the memories.

Bob Oldenburg
New York, NY

Bob, thanks for your words of encouragement. We had a great time working with Nick, Bob and Dave while we compiled the special 75th Anniversary issue. You can expect to see other retro articles throughout the coming year. GY

OIL AND PLUGS

I have been reading your "Thinking Big" column for several years, and I hope you

can answer a few gas-engine questions for me. I just bought a new Zenoah G-26 and need to know which kind of oil mix to use. Also, how often should I check the spark plug, and what should the spark-plug gap be?

Jim Sullivan
Walpole, MA

Jim; the G-26 is a great engine, and you'll find that with a little care, it will last almost forever (barring any sudden impacts with the ground). When the engine is brand-new, I use an ashless, petroleum-based oil such as those offered by Ace, Agway and Lawnboy, and I mix it with the gas at a 40:1 ratio. After the first gallon, you can switch to a 50:1 mix ratio. After you have run four or five gallons through your engine (it can take that long to run in a gasoline engine), switch to a good synthetic oil such as Klotz or Amsoil. You can use these oils in ratios anywhere from 85 to 100:1. The newer synthetic oils do a great job of lubricating engine parts, and the higher ratio will improve performance. If you're just having fun, it's OK to stay with the less expensive petroleum oils.

I check my plugs for carbon buildup about every 20 to 25 flights. I set the plug gap at

0.025, but this really isn't critical. Some of my flying buddies set their gaps at 0.030 and 0.035, and I don't notice any performance difference. If you get a buildup of black carbon, however, don't be afraid to lean the high-end needle a little. Your plugs should be light brown; if they're light gray or white, your mixture is too lean. Good luck! *GY*

SERVO LOCATION

In your October 2003 issue's "How to Install a Gas Engine," the throttle servo is shown mounted on the firewall. I have been told that a servo should not be mounted less than 12 inches from a gas-ignition system because of potential radio interference. But some modelers have said that this isn't a problem. Did you use a fiber-optics isolator, or is interference not a problem? Thanks for your help.

Dave Asman
Sterling Heights, MI

Dave, I did not use any special equipment to install the throttle servo in the giant-scale Great Planes Pitts Special. The best thing to do when you set up a new model is to use whatever feels comfortable. For years, it has been accepted that keeping the radio gear as far away as possible from a gas engine is a good setup for minimal radio-frequency interference. If you have any concern about radio-frequency noise, go ahead and install your throttle servo in the fuselage, and use a plastic pushrod to connect it to the carb. This is still good advice. After many flights, I haven't found any problem with the Futaba Super 8 setup I used with the Pitts Special. Many giant-scale modelers who use modern radio equipment have found that gasoline-engine-generated radio-frequency noise is becoming much less of a concern. Just be sure to install your engine properly, use a resistor-style spark plug, and always perform a range-check with the engine running before you fly. *GY*

ENGINE BREAK-IN

I just purchased a new O.S. .46FX engine and need to determine the proper procedures for break-in. Looking through past issues, I found Dave Gierke's article from November 2001, and it is very clear. However, the O.S. manual gives a totally different method that includes running the engine alternately, every 10 seconds, from "4-cycle" to "2-cycle" through a full tank of fuel.

Mr. Gierke highly recommends that an ABC engine be run only in a rich 2-cycle operation, and his explanation makes a lot of sense. Does this hold true for the O.S. .46FX? Please help!

Robert E. Lee
[email]

Robert; I believe that your O.S. .46 is of the ABN type (nickel cylinder plating); therefore, it should be broken in as I have stated: short runs (2 minutes) at a slightly rich 2-cycle (never 4-cycling); allow complete cooling between runs (20 to 30 minutes will be sufficient); and the engine should hold a peaked setting without "sagging" (losing rpm) before it's ready to power your model. Have fun with your new engine! *Dave Gierke*

AIR SCOOP

by the Model Airplane News *crew*

NEW PRODUCTS hit the model airplane market all the time, so here's the inside source for what's hot and where you can get it. Every issue, we sift through product announcements, show reports, rumors and prototypes to let you in on the best and the latest. Remember, you saw it here first!

GREAT PLANES MODEL MFG.

Rapture 40

Enjoy exciting aerobatics without computer radios, expensive engines, or months of workshop time. With a 4-channel radio and an economical .40-size engine, the Rapture 40 performs powerful maneuvers and handles well enough to be a confident step up from a trainer. The kit features interlocking balsa and ply parts; an adjustable engine mount; adjustable servo rails; and a slide-out tray for the fuel tank for easy maintenance. Specs: wingspan—60 in.; wing area—635 sq. in.; weight—4.5 to 5.25 lb.; wing loading—16 to 19 oz./sq. ft.; length—46.5 in.; engine—.40 to .50 2-stroke or .40 to .52 4-stroke; radio—4-channel w/4 servos. It retails for $149.99.
Great Planes Model Mfg. (217) 398-6300; (800) 682-8948; greatplanes.com.

SAITO

FA-100TI INLINE TWIN

Looking for a 4-stroke twin that will fit in your .50-size warbird? Don't let this compact powerplant pass you by; it has the same innovative, offset inline design as the popular FA-200Ti yet it's half its size! Its unique cylinder arrangement gives it smooth throttle response and low vibration, so it's ideal for your next scale project. Specs: bore—24.8mm; stroke—18.6mm; weight—39.8 oz.; displacement—1.09ci; rpm range—2,000 to 10,500. The FA-100Ti costs $624.99.
Saito; distributed by Horizon Hobby Inc. (217) 355-9511; horizonhobby.com.

KAVAN

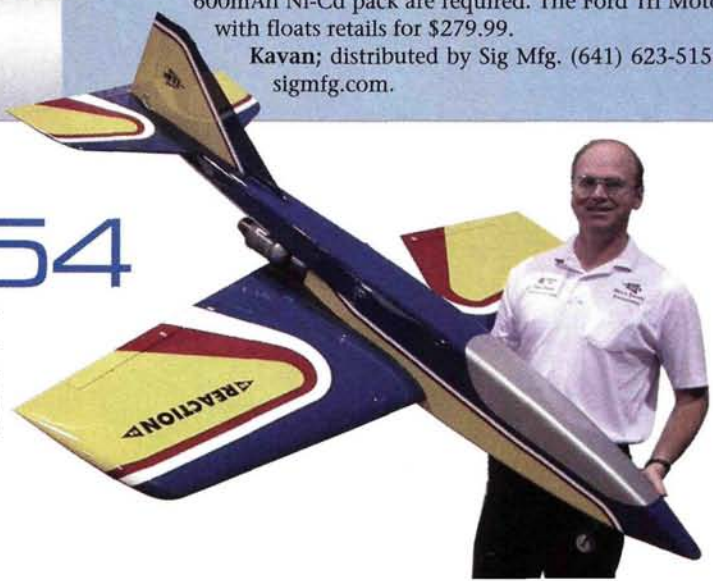
FORD TRI MOTOR WITH FLOATS

Take a step back in time with this classic! This foam ARF park flyer is a re-creation of a plane that was first used to transport passengers and mail from downtown Manhattan through New York City's first municipal airport: Floyd Bennett Field. The 41.7-inch-span model features light, foam construction with vacuum-formed plastic pieces, and it comes with three Speed 280 motors, APC propellers, scale decals, a complete hardware package (including switch harness) and an illustrated assembly manual. A 4-channel radio with four microservos and an 8-cell, 600mAh Ni-Cd pack are required. The Ford Tri Motor with floats retails for $279.99.
Kavan; distributed by Sig Mfg. (641) 623-5154; sigmfg.com.

BTE

REACTION 54

BTE is known for its line of high-quality kits, and now, the company brings its modeling and engineering expertise to the jet arena! The brand-new Reaction 54 features all-wood construction and is designed to be powered by an 11- to 12-pound turbine. The 78-inch-span model weighs 15 pounds ready to fly. Like all BTE kits, the Reaction 54 comes with sanded parts, photo-illustrated instructions and a complete hardware package.
Bruce Tharpe Engineering (800) 557-4470; btemodels.com.



FAN-TASTIC MODELS

AT-6

All-foam construction makes this electric model easy to assemble and damage-resistant. Scale panel lines and other details are molded into the foam parts, and the included clear canopy, plastic air intake, exhaust header and bellypan add the finishing touches. The 30-inch-span model needs a GWS IPS-DX2BB motor, 2A speed control, two microservos and 2, 340mAh Li-poly cells. It costs just $50.

Fan-Tastic Models; (817) 379-6468; fan-tasticmodels.com.

GIANTSCALEPLANES.COM

Mosquito ARF

This 73-inch-span warbird features a painted fiberglass fuselage, center section and cowls along with sheeted foam wings covered in Solartex and painted to match. All of the plane's control surfaces have beveled leading edges, and the control horn mounts come installed. The kit includes full-color decals. Two .25 to .32 2-strokes or .26 to .30 4-strokes and a 5- or 6-channel radio with seven to nine servos are required. The Mosquito costs $379.99.

GiantScalePlanes.com (610) 282-4811; giantscaleplanes.com.

MASTER AIRSCREW

K-SERIES

Though they're specifically designed for use with 4-stroke engines, this new series of propellers works great on 2-strokes as well. The K-Series propellers have diameters that range from 12 through 16 inches, and with wider blades and thinner airfoil sections, these props are efficient and powerful. Prices range from $3 to $9. Give one a try!

Master Airscrew; distributed by Windsor Propeller (916) 631-8385; masterairscrew.com.

AUTOGYRO CO. OF ARIZONA

Pitcairn Cabin Autogyro

Although it's designed specifically for brushless electric power, this sport-scale kit can also be built to use a conventional .25 2-stroke or .30 4-stroke engine. It sports a 48-inch-diameter rotor, is 34 inches long and requires only a standard 4-channel radio system. Its flight controls are the same as those of a model airplane; the elevator controls pitch; rudder controls yaw; throttle provides thrust; and "lateral tilt" replaces ailerons for effective roll control.

The Pitcairn Cabin is available in three versions. The standard kit ($199) comes with laser-cut parts, blades, rotor bearing, landing gear and some hardware. The deluxe electric ($249) and deluxe fuel ($259) versions include all finishing hardware.

Autogyro Co. of Arizona (623) 582-9482; (888) 783-0101; autogyro-rc.com.

JR

Venture 50 3D

Think you can't get 3D performance from a ready-to-fly heli? Think again! The new Venture 50 3D comes with its rotor head and mainframe assembled, so you need only bolt on the tail assembly and install the servos and the engine. It also has everything it needs for hot performance, including CCPM flight control, a limited-slip differential clutch, aluminum engine mount and center hub with thrust bearings; heavy-duty spindle with three dampers and a high-quality swashplate. Price? Just $349.99.

JR; distributed by Horizon Hobby Inc. (217) 355-9511; horizonhobby.com.

AEROJET MODEL AIRCRAFT

NORTHROP X-4 BANTAM

You don't see many models of this 1950s experimental jet at the field! The 47-inch-span profile model is 46 inches long and is designed to be powered by a Minifan 480. It comes with machine-cut balsa parts, CNC-cut foam-core wings that are sheeted with Obechi, a complete hardware package and instructions. The X-4 can be outfitted with retracts and can be bungee-launched. How does it fly? We hear it's a fantastic performer and nearly floats in for landings.

Aerojet Model Aircraft (281) 391-5480; aerojetmodelaircraft.com.

TAMIYA

AIRCRAFT SPRAY PAINT

These new Military Aircraft lacquer spray paints from Tamiya are ideal for dressing up closed-cell, foam park flyers as well as other projects, and they're designed to cover your model smoothly without sacrificing surface detail and panel lines. The 24 colors available were formulated to match color chips from full-size U.S., German, British and Japanese aircraft so you can stay true to scale. Cost? About $5 each.

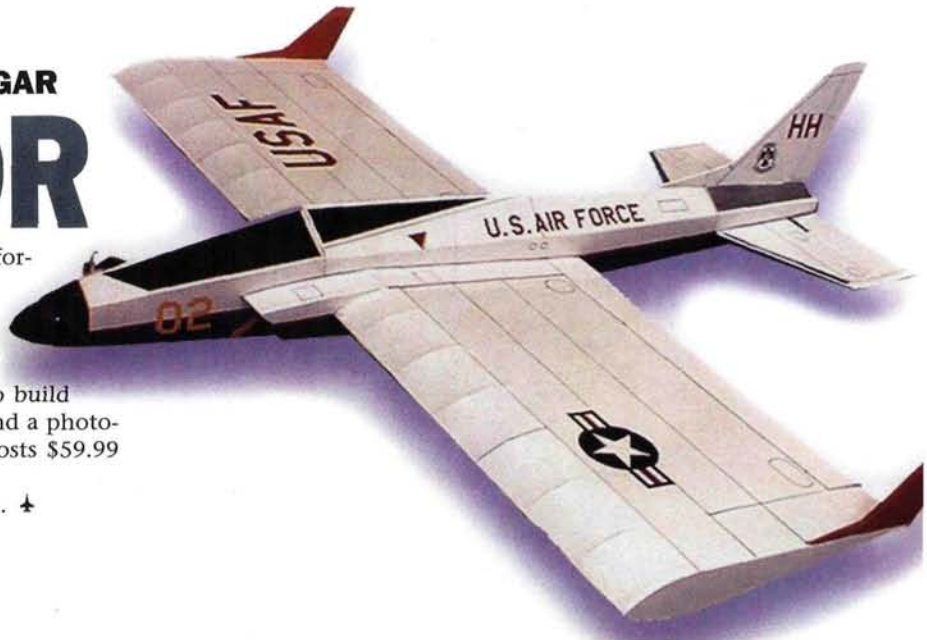
Tamiya (800) TAMIYA-A; tamiyausa.com.

HOBBY HANGAR

PREDATOR

This small, one-piece plane packs plenty of performance! With a .15-size engine in its nose, the 36-inch-span Predator is a combat-like, aerobatic flyer that's ideal for intermediate and advanced pilots. It requires 3-channel control with optional rudder. The all-wood kit is easy to build and comes with laser-cut parts, a full-size plan and a photo-illustrated assembly manual. The Predator kits costs $59.99 plus $7.40 S&H.

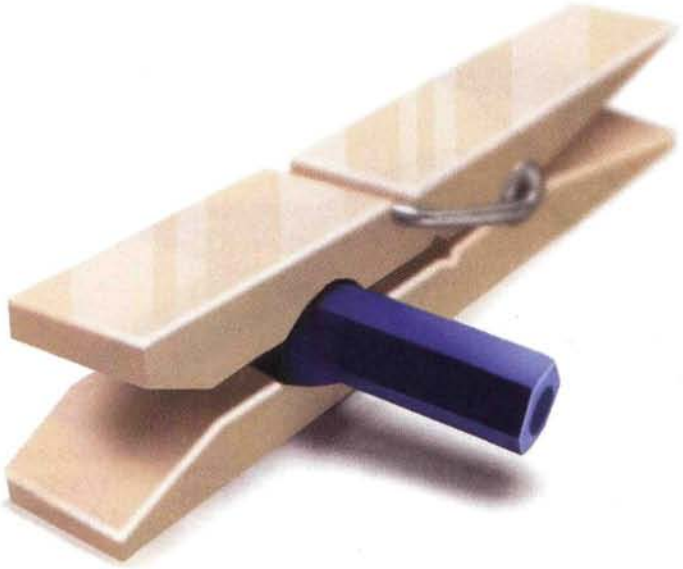
Hobby Hangar (321) 727-8227; hobbyhangar.com.



TIPS & TRICKS

Illustrations by Richard Thompson

SEND IN YOUR IDEAS. *Model Airplane News* will give a free, one-year subscription (or a one-year renewal, if you already subscribe) for each idea used in "Tips & Tricks." Send a rough sketch to *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. BE SURE THAT YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can neither acknowledge each one nor return unused material.



CLOTHESPIN BALL-CUP HOLDER

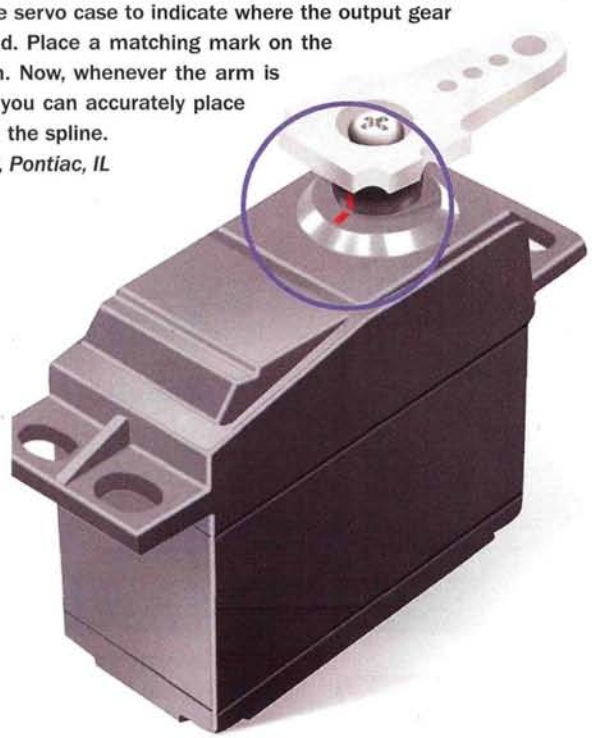
A spring-type clothespin works well as a ball-cup holder. The wood won't mar the plastic, and the clothespin gives you much more leverage. If necessary, you can use a hobby knife to enlarge the opening in the clothespin's jaws to fit your ball cups.

Tom Canter, Madison, CT

EASY-FIND SERVO CENTER

It's always best to properly center your servo with the transmitter. When the servo is centered, mark a tooth and make a corresponding line on the servo case to indicate where the output gear is centered. Place a matching mark on the servo arm. Now, whenever the arm is removed, you can accurately place it back on the spline.

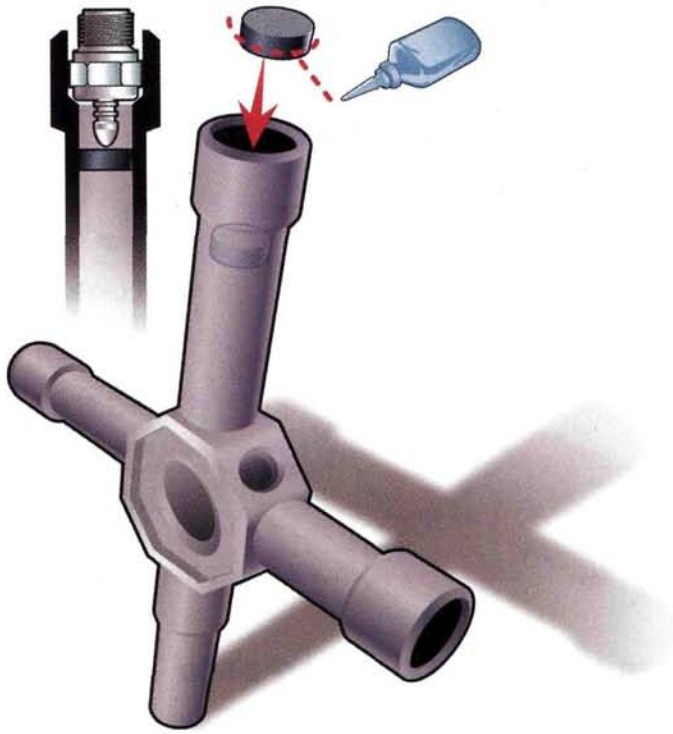
Tim Daley, Pontiac, IL



GLOW-PLUG WRENCH MOD

Glow-plug wrenches that aren't able to hold the glow plug while you insert or remove it from your engine can be a pain. To make that job easier, CA a magnet into the center of the wrench. The magnet will hold the glow plug in the wrench for no-fuss installations and removals.

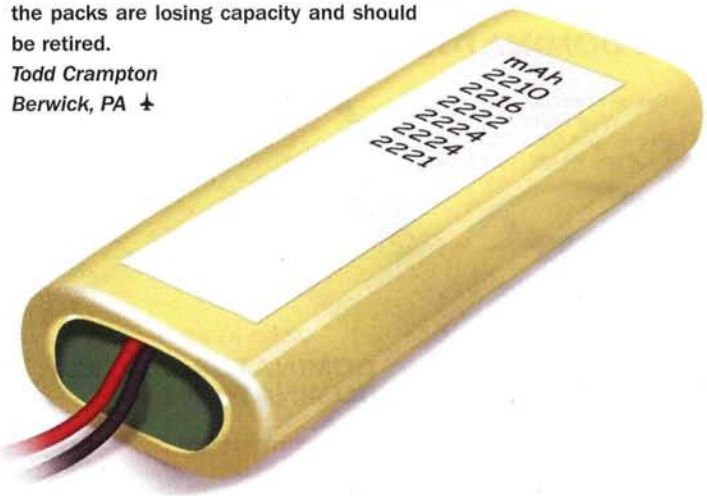
Jason Nault, Rochester, NY



BEST BATTERIES

Take advantage of your digital charger. Place a white address label on each of your packs and record the peak voltage and capacity after each charge. This will allow you to track each pack's performance so that you can better determine when the packs are losing capacity and should be retired.

Todd Crampton
Berwick, PA ✈



PILOT PROJECTS

SEND IN YOUR SNAPSHOTS. *Model Airplane News* is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable, but please do not send digital printouts or Polaroid prints. Emailed submissions must be at least 300dpi. We receive so many photographs that we are unable to return them. All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of the year. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in! Send those pictures to "Pilot Projects," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA.

⅓-SCALE LASER
John Geyer
El Paso, TX

Third-generation RC nut Ryan Geyer looks ready to take off in dad John's Lanier RC ⅓-scale Laser! John added a Hitec Q-PCM radio, a ZDZ 80 engine and a 26x10 prop. He says the plane has unlimited vertical performance and flies great.

RV-4
Billy Hare
Charlotte, NC

Fifteen-year-old Billy has been flying RC for a couple of years, and this Great Planes RV-4 is his first kit-built plane. It's covered in Ultracote, is powered by an MDS .40 engine with a Bisson Pitts muffler and is guided by a JR radio. Billy tells us, "It was fun to build and looks awesome!"

YAK-3
John Giles, Oklahoma City, OK

Built from Jerry Bates plans, this 68-inch-span YAK-3 has Robart retracts with Oleo struts, a retracting tailwheel and flaps. John powers it with a Saito 1.80 and controls it with a Futaba radio. He covered it with MonoKote and created the camo scheme with spray paint. It weighs 13 pounds and, according to John, it flies like a dream.

DE HAVILLAND BEAVER
Paul Butcher, Sault Ste. Marie, Ontario, Canada

Paul's latest giant-scale project, this 12-foot-span, 43-pound de Havilland Beaver, is powered by a 71cc Pioneer chainsaw engine. Says Paul, "It looks majestic in the air," and we don't doubt it; it looks pretty majestic on the ground, too.

KIT-BASHED RED-TAILED HAWK
Jim Silva, Portland, OR

Jim built this impressive red-tailed hawk from the Turkey Vulture plan featured in the June 2002 issue of *Model Airplane News*. He explains, "We have no turkey buzzards around here, but there is a family of red-tailed hawks that cruises our back fields, so a little 'kit-bashing' was in order." Nicely done!

by Gerry Yarrish

Classic Model Airplane News

SNOOPY'S FLYING DOGHOUSE

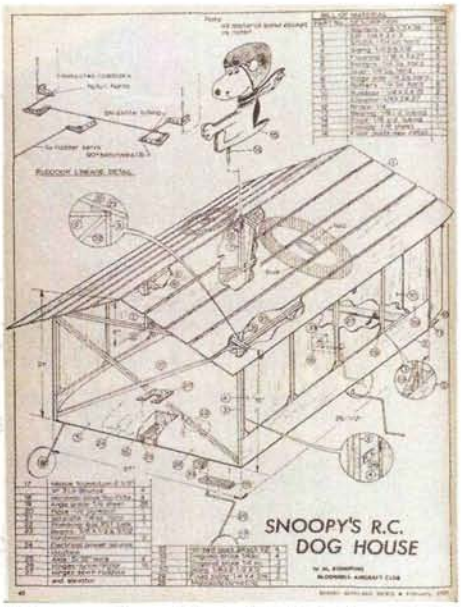
Though long interested in presenting the very latest in RC modeling technology, *Model Airplane News* has always been able to retain its sense of humor. Modelers are an ingenious lot, and over the years, there have been all sorts of flying models that looked as if they shouldn't! When it comes to construction articles and plans, the most famous of them all has to be Snoopy's Flying Doghouse designed by Al Signorino.

First published in the January 1969 issue, Snoopy and his doghouse debuted at the 1968 Rhinebeck WW I Jamboree. The detailed drawings for this aerial K9 condo were published in the February 1969 issue and inspired many copycats who just had to have their own flying beagle! Then, in the April 1971 issue (the cover of which is shown above right), *Model Airplane News* offered a revised and much improved version of the plans. The new model was some 2 pounds lighter and sported a new, better-performing airfoil that made the doghouse much more airworthy and maneuverable.

Other changes included an extension for the engine mount that moved the engine several inches forward of the airfoil (originally, the engine was inset in the leading edge). Also, all but the front two side panels (one on each side) were made stationary. Originally, all the side panels were pinned so that they could swing about like doors to allow crosswind gusts to pass through the structure. Snoopy sat on top of the roof with a pin and tube arrangement, so he was free to weathervane as the model flew.

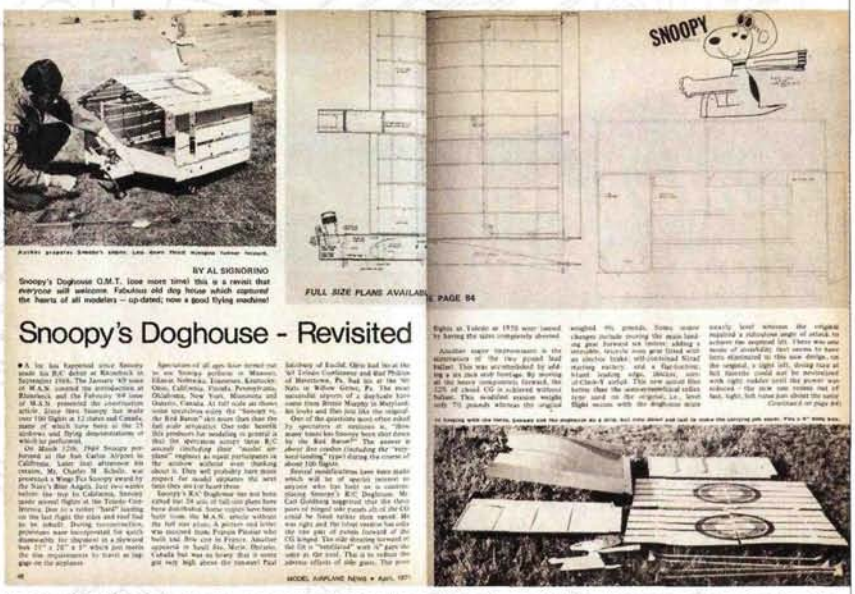
Snoopy's original choice of equipment included an Enya .60 II engine turning an 11x7 prop and an M.A.N. 2-3-4 radio with S4a and S4c servos. The plans sold for an impressive $4.25.

When it comes to novelty designs like flying Formula 1 racecars, lawn mowers and witches on broomsticks, they all owe a bit of gratitude to Snoopy's original "Curse you, Red Baron!" design! Who says you can't teach an old dog new tricks?



This was the original detailed drawing for Snoopy's Doghouse.

Snoopy stole the show at the 1968 Rhinebeck WW I Scale Jamboree!



In the April 1971 issue, Snoopy really became an ace! The revised plans made the Doghouse much more airworthy and easier to fly.

AND THE WINNERS ARE...

1ST PLACE: EXPERT

1ST PLACE: TEAM

When the dust settled, three class winners were left standing. Jeremy Fursman took first in Expert, George Maiorana with pilot Dave Pinegar captured the number-one spot in Team andDavid Hayes earned first place in Designer!

Winner of the Best Scale Markings award, Dave Wigley brings in his Hawker Tempest Mk.V. Dave's 1/5-scale model was built from Vailly Aviation plans and placed 5th in Expert. It has a 96-inch span, is powered by a Quadra 75 gas engine and weighs 45 pounds.

24TH ANNUAL U.S. SCALE

1ST PLACE: DESIGNER

BY GERRY YARRISH

MASTERS CHAMPIONSHIPS

A tradition of excellence continues in Dayton

Every year throughout the country, scale modelers compete at local and regional events for a chance at the "big time"—the U.S. Scale Masters Champion-ships. Always held at a different location, in 2003, it was held on September 24 to 28 in Dayton, Ohio—a most appropriate setting, considering that 2003 marked the 100th anniversary of powered flight! Now in its 24th year, the U.S. Scale Masters Championships was hosted by the Westerville Model Aeronautics Association. The event was held adjacent to the splendid U.S. Air Force Museum at Wright-Patterson Air Force Base. The U.S. Scale Masters Association (USSMA) organizes the championships and coordinates the numerous qualifiers run by various RC clubs. For the Championships, modelers compete and earn their places on the flight roster.

Tenth in Designer and winner of the Best WW I Aircraft award, David Johnson flew this unusual Siemens Schuckert D.III. The 15-pound biplane has an 84-inch span and is powered by a Brison 2.4 gas engine. Plans are available from Model Airplane News.

In 2003, 19 qualifiers were held in the U.S., Canada and Brazil. The top 30 percent of finishers at each event in the Team Scale and Expert classes are eligible for the final rounds flown at the Championships. With such a "laddered" approach, the caliber of the competition is quite high. Of the 83 qualifiers in Dayton, only two aircraft were damaged; both succumbed to unexpected mechanical problems. This almost nonexistent attrition rate is a trademark of the Scale Masters competition.

The event began with static judging set up just outside of the museum's impressive Memorial Park area. Each contestant was photographed with his model after it had been judged. These photos were then displayed on the scoreboards at the flying field. This great arrangement made it easy for the 3,000 spectators to identify and keep track of the progress of their favorite pilots.

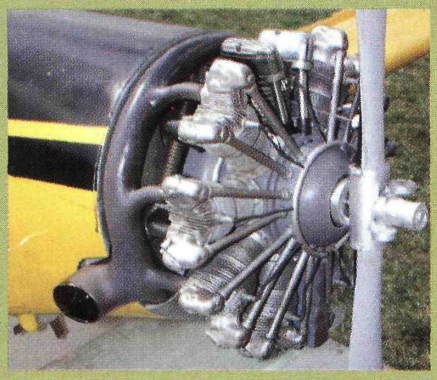
At Wright-Patterson Air Force Base, the Championships enjoyed an unlimited length of paved runway. Most models flew off the hard surface, but a few vintage-era tailskid-equipped planes used the grass strip next to the tarmac. Airspace was totally unrestricted with the exception of a maximum-400-foot-altitude limit. Four or five models were always in the air. Each flight station had its own set of judges and a safety lineman who was in constant radio communication with a single air boss! The flightline operation ran very smoothly all weekend. Each pilot had to be cleared before he could take off or land, and everyone benefited from this attention to procedure and safety.

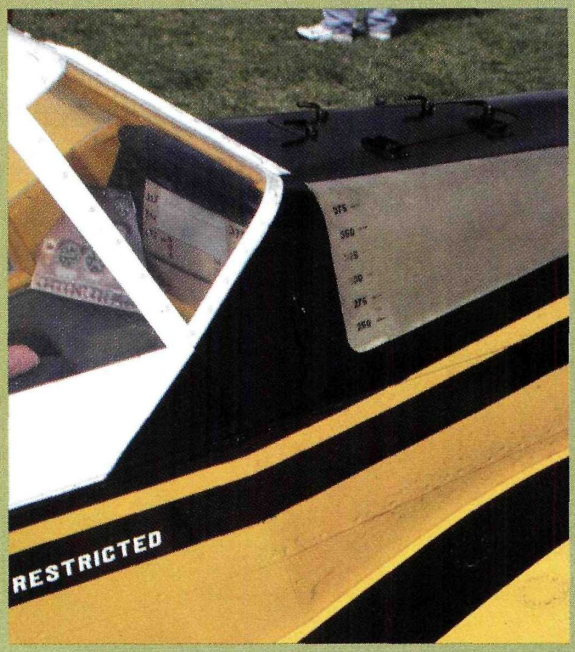
Second in Designer, Shailesh Patel flew this beautiful scratch-built F-86 Sabre Jet. Powered by an AMT Olympus turbine engine, the sweptwing jet weighs 45.5 pounds and spans 96 inches.

PHOTOS BY GERRY YARRISH

GRAND CHAMPION

Coming in for a low crop-dusting pass, David Hayes' Rockwell Thrush looks exactly like the full-size Ag-plane. The Thrush has an 108-inch span and is powered by a Saito 1.80 4-stroke engine. Dave's scratch-built model weighs 21 pounds.





Who says you need a jet to win in scale! The big trophy for Grand Champion went to David Hayes with his impressive Rockwell Thrush cropduster. David also earned the High Static score and the Best Civilian, Best Mission (Expert) and Best Scratch-Built awards.

2003 SCALE MASTERS CHAMPIONSHIPS
FINAL STANDINGS

GRAND CHAMPION

David Hayes — Rockwell Thrush

DESIGNER *First year for this separate class*

PLACE	PILOT	AIRCRAFT	STATIC	FLIGHT	TOTAL
1	David Hayes	Rockwell Thrush	97.25	92.417	189.667
2	Shailesh Patel	F-86 Sabre Jet	97.25	91.750	189.000
3	Jeff Foley	Bf-109e	96.50	92.500	189.000
4	Bob Patton	T 28 C	95.00	91.750	186.750
5	Charles T. Nelson	YKS 7 WACO Cabin	95.00	91.250	186.250
6	Hal Parenti	Ryan Fireball FR-1	96.25	89.250	185.500
7	Wayne Frederick	Fokker D.VIII	96.00	86.000	182.000
8	Tom Polapink	Pfalz D.IIIa	95.25	86.500	181.750
9	Charles Baker	Rawdon T1	96.50	84.500	181.000
10	Dave Johnson	Siemens Schuckert D.III	95.00	84.417	179.417
11	Nick Ziroli Sr.	Stearman PT-17	94.00	78.583	172.583

Mike Winter flew this striking ⅓-scale Sopwith Pup to 22nd in Expert. Powered by a Sachs 4.2 gas engine, the model was built from a modified Balsa USA kit and has a 106-inch span.

First-place Expert Jeremy Fursman flies a DH-82A Tiger Moth that's more tiger than moth! The ¼-scale biplane was built from a Duncan Hudson kit and is powered by a Laser 150. The model was hand-painted with Nelson water-based paints. Jeremy also won the Best Biplane award.

CLASSES AND RULES

Usually, the two main classes are Expert and Team Scale, but for 2003, a new Designer Scale class was introduced. Drawn from the Expert entrants, all competitors in Designer Scale flew models built from their own plans. Modelers in the Team and Expert classes could fly models that had either been built from kits or from someone else's plans.

The USSMA has its own rules that you can download from its website; scalemasters.org. Scoring is based on the two main categories, Static and Flight judging. In Static, the model is placed on a viewing table, and the contestant gives his documentation package to the static judges, who use it to evaluate the model's fidelity to outline shape, finish color, marking accuracy and level of craftsmanship. Photographs, 3-view line drawings and color samples are all used to judge the overall quality of a participant's model.

During flight judging, scores are awarded for how well the pilot controls and guides his aircraft. Each pilot fills out his flight-judging sheet and gives it to the judges to score. Ten maneuvers are required for each flight round; they consist of four mandatory and five optional maneuvers. The 10th maneuver judged is the model's overall flight realism, and this is judged during the entire flight, including times between actual scored maneuvers. Mandatory maneuvers include takeoff, figure-8, fly past (10- to 20-feet altitude) and landing. Optional flight maneuvers include procedure turns, chandelles, various roll types, slow-speed inspection flights, descending 360-degree turns and so on. Descriptions of each maneuver and reasons for downgrades are listed in the USSMA rulebook.

The contestants start each maneuver with 10 points, and the judges deduct for deviations in precision, placement and realism. Depending on the number of rounds flown, the pilot's flight score is the average of his three best scores. The flight score is then added to the static score to determine the contestant's overall score.

ON THE FLIGHTLINE

The weather for the Championships was a little breezy but bright and sunny, except on Friday afternoon, when rain closed down the flight operations early. Since the museum was just on the other side of the field, most contestants did not complain! What better reason to visit one of the country's best aviation museums?

The weekend was nonstop flying; and thanks to everyone's being on deck and ready to go when they were supposed to be, everybody flew four rounds. As usual, the final scores were very close. All pilots flew at a very high level, and many praised the judging for being very fair and consistent. Jeremy Fursman flew his beautifully painted de Havilland DH82-A Tiger Moth to first place in Expert, moving up from fifth

Bob Patton placed fourth in Designer with this colorful T-28 C Trojan. The 23-percent-scale model has a wingspan of 114 inches and weighs 53 pounds. Power comes from a 3W-100 gas engine.

2003 SCALE MASTERS CHAMPIONSHIPS
FINAL STANDINGS

EXPERT

PLACE	PILOT	AIRCRAFT	STATIC	FLIGHT	TOTAL
1	Jeremy Fursman	de Havilland DH 82-A	95.50	93.583	189.083
2	Kim Foster	DH 94 Moth Minor	97.00	91.417	188.417
3	Kent Walters	SBD-3 Douglass Dauntless	96.25	90.833	187.083
4	Joe Rafalowski	T-33	94.50	92.083	186.583
5	Dave Wigley	Hawker Tempest Mk. V	96.00	88.750	184.750
6	Steve Ort	B-25 Mitchell	94.75	89.333	184.083
7	Sean M. Cassidy	F6F-5 Hellcat	95.75	88.000	183.750
8	Jeff Lovitt	Kawasaki KI-61 Tony	93.75	89.583	183.333
9	Dave Pinegar	T-34A Beech Mentor	90.25	92.917	183.167
10	Leo Spychalla	Spitfire MK. XIV	92.00	90.000	182.000
11	Dennis Crooks	P-38	95.00	86.917	181.917
12	William Wheeler	Piper J-3 Cub	91.50	90.417	181.917
13	Glenn Reilly	Focke-Wulf 190-A8	95.25	86.083	181.333
14	Steve Forrest	Republic P-47	91.00	90.250	181.250
15	Doug Crumley	Fieseler Storch	94.25	86.750	181.000
16	Ward Emigh	T-23	92.50	88.333	180.833
17	Al Kretz	Dauntless SBD-3	94.75	85.833	180.583
18	Zach Spychalla	Spitfire FR MK. XIVe	92.25	88.167	180.417
19	Dave Lovitt	YAK 18P	89.75	90.583	180.333
20	Jack Buckley	F4U-1A Corsair	90.25	89.667	179.917
21	Bill McCallie	Focke-Wulf 190	89.75	90.000	179.750
22	Mike Winter	Sopwith Pup	92.50	86.933	179.433
23	Bob Wonitoy	Focke-Wulf 190A-8	93.75	85.583	179.333
24	Paul Cain	Cap 231 Ex	89.50	89.250	178.750
25	Dick Hansen	Albatros DVA	92.00	86.250	178.250
26	Bob Gillespie	Nieuport 28-C	95.00	83.167	178.167
27	Bud Roane	Shoestring	90.50	87.500	178.000
28	Scott Foster	P-47 Thunderbolt	90.00	87.250	177.250
29	Richard Crupi	Piper J-3 Cub	88.00	89.000	177.000
30	Larry Sutherland	T-34A Beechcraft Mentor	95.50	81.333	176.833
31	Skip Mast	Piper J-3 Cub	90.25	86.500	176.750
32	Chip Greene	Grumman F-8F-2 Bearcat	88.75	87.916	176.666
33	Ray Davis	F-15 Eagle	89.75	86.500	176.250
34	Jeffrey Pike	U1-A Otter	88.00	88.167	176.167
35	Jeremy Arvin	CAP 21	88.25	87.667	175.917
36	Mel Santmyers	Citabria Pro	91.00	81.583	172.583
37	Randy Smithhisler	Piper J-4 Cub Coupe	87.75	83.500	171.250
38	Larry Shepard	Sopwith 1½ Strutter	89.75	80.667	170.417
39	John Ostmeyer	WACO UPF-5 Classic	90.25	75.667	165.917
40	Gary Parenti	Be 50 Beta Minor	89.75	68.500	158.250
41	Lee Rice	F4U1D Corsair	95.00	31.000	126.000
42	Bruce Bender	Spitfire Mk XIVE	93.75	26.333	120.083
43	Steve Sauger	Fairchild Ranger	92.75	16.083	108.833
44	Stan Clark	L-19 Bird Dog	88.75	5.083	93.833

2003 SCALE MASTERS CHAMPIONSHIPS FINAL STANDINGS

TEAM

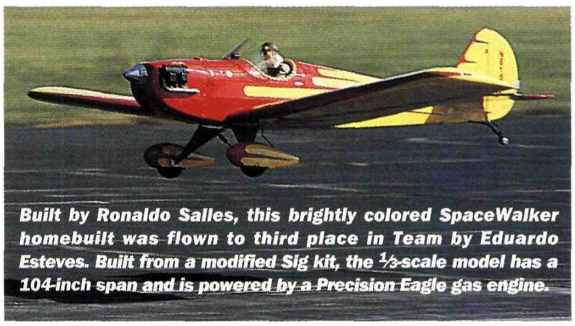
PLACE	PILOT	AIRCRAFT	STATIC	FLIGHT	TOTAL
1	Dave Pinegar George Maiorana	TU-4 AEW	97.00	90.000	187.000
2	Scott Russell Wayne Siewert	P-47D Thunderbolt	95.75	89.167	184.917
3	Eduardo D. Esteves Ronaldo Salles	SpaceWalker	95.00	89.833	184.833
4	Jay Steward Jack Steward	Nieuport 28c	95.25	88.417	183.667
5	Paul Haynes Steve Wilson	Nieuport	95.25	84.584	179.834
6	Curtis Kitteringham Ron Peterka	Stinson SR-9 Gull Wing	91.75	88.083	179.833
7	Brian O'Meara James Hammond Jr.	KI-61 Tony	93.00	86.750	179.750
8	Nil Patel Shailesh Patel	F-4 Phantom	95.75	83.417	179.167
9	Wayne Frederick Vernon Altamirano	Cessna 182 Skylane	95.00	83.583	178.583
10	Mike Gross Tony Kirchenko	Stearman PT-17	92.25	85.750	178.000
11	Mike Barbee Earl Muenze	Fairchild M-62	91.50	85.917	177.417
12	Dorin Luck Gary Allen	Bu133 Bücker Jungmeister	92.25	84.417	176.667
13	Reg Dell-Aquila Frank R. Banks	P-38L	92.50	82.417	174.917
14	Steve Ort John Colby	B-24 Liberator	90.50	81.250	171.750
15	Dale Arvin Earl Dever Sr.	Cessna 182	85.25	85.667	170.917
16	Jeremy Arvin Earl Dever Jr	Stinson DR-9	84.50	85.333	169.833
17	Wayne Knight Bob Walter	P-51 Mustang	86.75	68.333	155.083
18	David Malchione Mark Frankel	Douglas F4D-1 Skyray	92.50		

place last year. David Hayes with his Rockwell Thrush agricultural cropduster was awarded first place in Designer. The first-place Team winners were George Maiorana/Dave Pinegar and their impressive Soviet Tupolev Tu-4 AEW. In most cases, less than a half point made a big difference!

The 2003 Championships ran very smoothly, indeed. Contest director Mike Barbee, vanguard team leader Marc Wade, field marshals John Boyko and Bob Buchwalter and air boss Mike Leonard—as well as all the other hard-working members of the Westerville Model Aeronautics Association—did a bang-up job of making this ultimate scale competition a complete success.

Kansas City, KS, is the place for the 2004 Championships, so be sure to check the USSMA's website for the latest information. If you want to see this tradition of scale excellence firsthand, come to the 25th annual championships. See ya there!

Larry Sutherland flew this impressive T-34A to 30th in Expert. Powered by a Laser 300, this ¼-scale, 100-inch-span Mentor was built from a Mark Frankel kit and weighed 40 pounds.



Built by Ronaldo Salles, this brightly colored SpaceWalker homebuilt was flown to third place in Team by Eduardo Esteves. Built from a modified Sig kit, the ⅓-scale model has a 104-inch span and is powered by a Precision Eagle gas engine.

2003 SCALE MASTERS QUALIFIER EVENTS

GUNSMOKE SCALE QUALIFIER
Mesa, AZ—February
CD: Victor Westlund;
(480) 924-2585 (evenings);
conjii@juno.com;
azmodelavitors.com.

TEXAS SCALE CHAMPIONSHIPS
Fort Worth, TX—May
CD: Lawrence Harville;
(817) 589-2636;
lawharv@yahoo.com;
fwthunderbirds.org.

TOP GUN
Lakeland, FL—April
CD: Frank Tiano; (561) 795-6663;
ftiano@aol.com; franktiano.com.

AMA NATS
Muncie, IN—June
CD: Dale Arvin; (812) 284-0162;
darvin8094@aol.com;
modelaircraft.org.

MINT JULEP SCALE MEET
Rough River, KY—May
CD: John Guenther;
(812) 967-2814;
jmaguenther@yahoo.com.

NEW ENGLAND SCALE CHAMPIONSHIP
Gardner, MA—June
CD: James Sbrogna;
(508) 481-0955;
newenglandscale@yahoo.com.

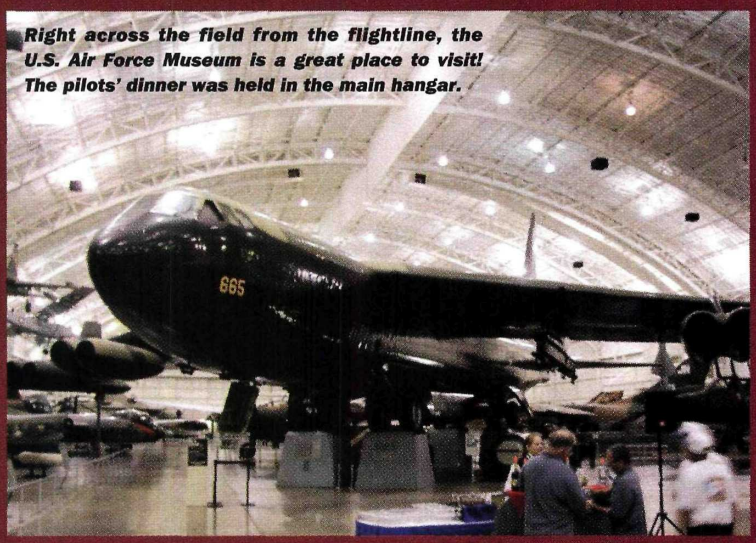
SW IDAHO SCALE MASTERS QUALIFIER
Nampa, ID—June
CD: Ray Schellekens;
(208) 658-6767;
rayschell@msn.com.

EVERGREEN SCALE RALLY
Molalla, OR—August
CD: Dale McDonald;
(503) 761-3109;
dalemcdonald@attbi.com;
sky-knights.org.

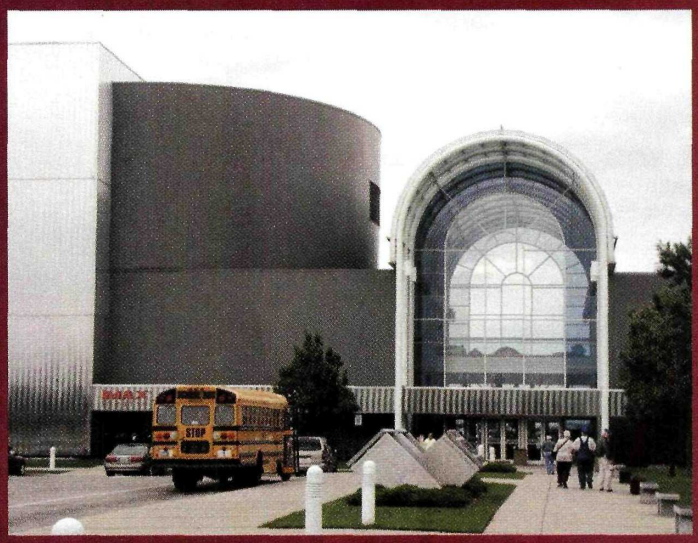
LONG ISLAND SCALE MASTERS QUALIFIER
Eastport, NY—August
CD: Nick Ziroli Jr.;
(631) 476-8522;
day (631) 467-3932;
zirolijr@aol.com.

Zach Spychalla flew this impressive-looking 1/5-scale Spitfire FR Mk. XIVe to 18th place in Expert. Powered by a ZDZ 40 gas engine, the 92-inch-span model was built from a modified Yellow Aircraft kit and weighs 27 pounds.

SOMETHING SPECIAL



Right across the field from the flightline, the U.S. Air Force Museum is a great place to visit! The pilots' dinner was held in the main hangar.



The pilots' banquet on Thursday evening was hosted in the museum's main hangar and was set up between the B-52 Stratofortress and the C-124 Globemaster. Hanging from the rafters, famous UAVs—the Predator and the Global Hawk—kept the airspace clear of enemy aircraft! After dinner, everyone was free to investigate the museum's impressive collection of 300 aircraft and given a chance to climb into some of the open cockpits—a very special treat!

Saturday evening's award dinner was at the headquarters hotel. The USSMA's national chairman, Earl Aune, and contest director, Mike Barbee, presented the many special awards and discussed the latest developments of importance to the organization. The evening's keynote speaker, AMA president Dave Brown, spoke about scale competition and the recent nonstop RC Atlantic crossing achieved by Maynard Hill and his crew. The evening ended with an open invitation to platinum sponsor Pacer Technology's taproom, graciously stocked by Zap Gang leader Herschel Worthy.

MID-STATES SCALE CLASSIC
Hillsdale, KS—June
CD: John Ostmeyer; (913) 451-1602; johnostmeyer@sprintmail.com.

49'ER QUALIFIER
Woodland, CA—May
CD: Hank Cavasso; (707) 762-5376; hankcavasso@aol.com; wdarc.org.

WESTERN REGIONAL
El Toro, CA—June
CD: Sam Wright; (949) 766-9786; sam-w@cox.net.

SOUTH BAY QUALIFIER
Livermore, CA—July
CD: Jeff Whitney; (510) 537-0141; bmxdad505@aol.com.

HIGH PLAINS SCALE CLASSIC
Pueblo, CO—June
CD: Larry Osborn; (719) 566-0488; osbornlarry@hotmail.com; milehirc.com.

WESTERN CANADIAN REGIONAL
Winnipeg, Manitoba, Canada—June
CD: Gerry Fingler; (204) 663-1051; cdhobby@pangea.ca.

ALBERTA SCALE
Edmonton, Canada—June
CD: David Pape; (780) 481-5533; dpape@ualberta.ca.

KING ORANGE SCALE
Sarasota, FL—June
CD: Bill McCallie; (813) 932-0622; sarasotarc.com.

S.I.R/C.M SCALE CLASSIC
New Albany, IN—August
CD: Dale Arvin; (812) 284-0162; darvin8094@aol.com.

CORVIN MILLER MEMORIAL
Sarasota, FL—November
Winter; (941) 966-7786; mikeandeva@comcast.net; sarasotarc.com.

Contact
U.S. Scale Masters Association Inc.,
21952 Airport Rd.,
Aurora, OR 97002;
(503) 678-6458;
fax (503) 678-6036;
jensendes@centurytel.net.

SCALE MASTERS TECH TALK

RADIOS

Futaba	42
JR	24
Airtronics	16
Hitec	1

ENGINES

O.S.	19
Zenoah	9
Saito	8
Laser	6
Moki	5
Brison	4
Quadra	3
YS	3
Webra	2
ZDZ	2
3W	2
SuperTigre	2
Robart	2
Seidel	1
U.S. Engines	1
Precision Eagle	1
Husky	1
Enya	1
D&B	1
Cheetah	1
Sachs	1

TURBINES

RAM	1
JetCat	1
AMT	1

ELECTRIC MOTORS

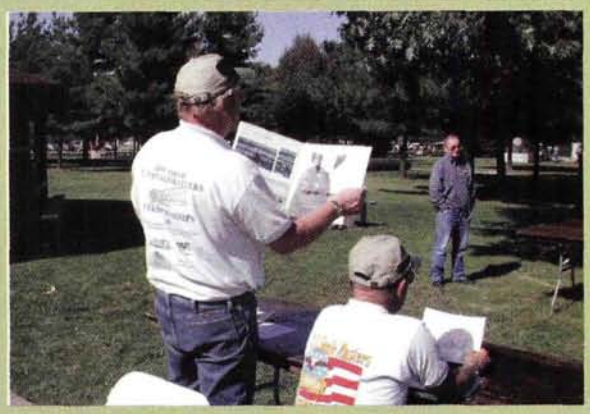
AstroFlight	1
MaxCim	1

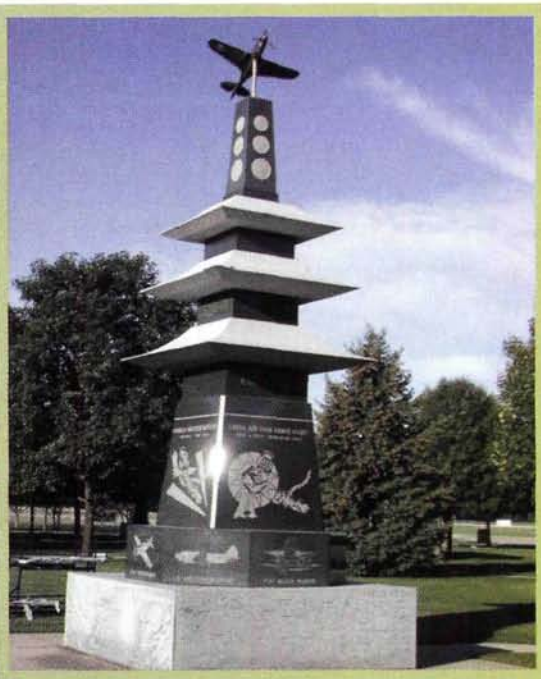
AIRCRAFT CONSTRUCTION

Scratch-built own design	29
Kit-built	37
Plans-built	17

Nil Patel flew this turbine-powered BVM F-4 Phantom with his dad Shailesh to eighth place in Team. Nil, 14, was the youngest pilot at the Championships!

STATIC JUDGING





Static judging was held at the Memorial Park just outside of the main museum. Excellent surroundings for a scale meet.

Powered by a Saito 180, this Shoestring racer is the work of Bud Roane. Weighing 22 pounds, Bud's pylon racer (27th Expert) was built from his own plans and spans 83.5 inches.

2003 SCALE MASTERS SPECIAL AWARDS

AWARD	RECIPIENT	AIRCRAFT	SPONSORED BY
High Static Score (97.25)	David Hayes	Rockwell Thrush	Westerville Model Aeronautics Assoc.
(tied scores)	Shailesh Patel	F-86 Sabre Jet	
High Flight Score (96.5)	Dave Pinegar	TU-4 AEW	One Eighth Air Force
Best Biplane	Jeremy Fursman	DH 82A Tiger Moth	Kelly Christ
Best Built-Up Kit	Zach Spychalla	Mk. XIV Spitfire	Marv Wade
Best Civilian	David Hayes	Rockwell Thrush	RC Hobbies
Best Documentation	Al Kretz	Dauntless SBD-3	Bob Holman Plans
Best Golden Age	Charles T. Nelson	WACO YKS-7	Sanderson & Assoc.
Best Jet	Shailesh Patel	F-86 Sabre Jet	Robart Mfg.
Best Markings	Dave Wigley	Hawker Tempest Mk-V	Planes Plus
Best Military	Shailesh Patel	F-86 Sabre Jet	Marv Wade
Best Mission (Expert)	David Hayes	Rockwell Thrush	Airtronics
Best Mission (Team)	Curtis Kitteringham	Stinson SR-9 Gull Wing	Airtronics
Best Scratch-Built	David Hayes	Rockwell Thrush	Capstone Hobbies
Best WW I	David Johnson	Siemens Schuckert D.III	Proctor Enterprises
Best WW II	Reg Dell-Aquila	P-38L Lightning	Vel-Tye LLC
Engineering Achievement	George Maiorana	TU-4 AEW	Southern Alameda County RC'ers
Harris Lee Lifetime Achievement	Mike Winter	Sopwith Pup	Scale Masters Assoc.
Most Realistic Flight			
Expert	William Wheeler	Piper J-3 Cub	Airtronics
Team	Curtis Kitteringham	Stinson SR-9	Airtronics
Pilots' Choice	Shailesh Patel	F-86 Sabre Jet	One Eighth Air Force

2003 SCALE MASTERS SPONSORS

PLATINUM
Pacer Technology
Raper RVs

GOLD
Airtronics
Barbee Construction
Dinneen Excavation

SILVER
Bob Banka Aircraft Documentation
Bob Smith Industries
Great Planes Model Manufacturers
Proctor Enterprises
Robart Mfg.
U.S. Scale Masters Association

PATRON
Wing Mfg.

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Arizona RC Society
Bob Holman Plans Service
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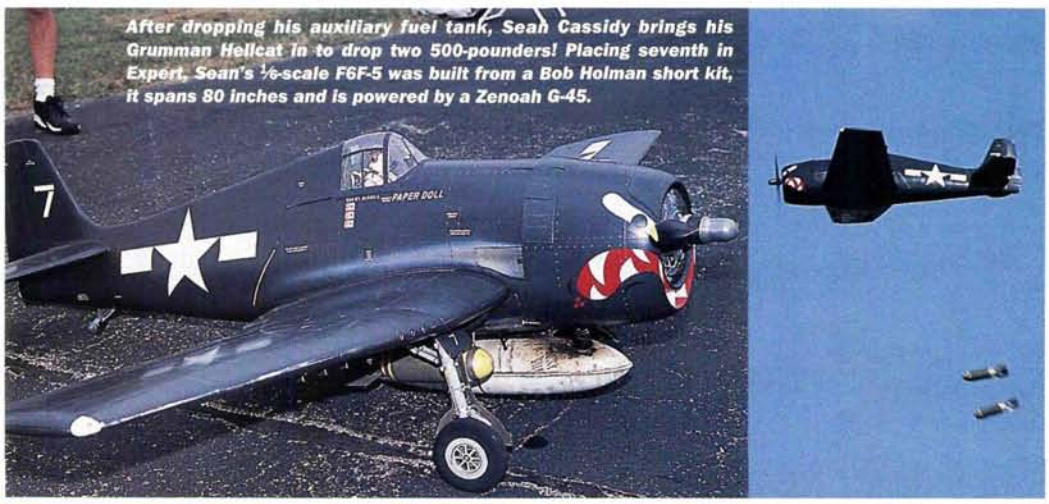
Hansen Scale Aviation Videos
Nelson Hobby Specialties
Nick Ziroli Plans
RC Excellence magazine
SR Batteries
SkyKnights RC Club



After dropping his auxiliary fuel tank, Sean Cassidy brings his Grumman Hellcat in to drop two 500-pounders! Placing seventh in Expert, Sean's ⅛-scale F6F-5 was built from a Bob Holman short kit, it spans 80 inches and is powered by a Zenoah G-45.

Flying to third place in Designer, this Bf-109E was flown by Jeff Foley. The 86-inch-span German fighter weighs 25 pounds and is powered by a Moki 2.10 glow engine.

High overhead, the Tu-4 with its early-warning radar dome rotating patrols the skies over Wright-Patterson.

This Mk. XIV Spitfire was flown by Leo Spychalla to 10th place Expert. Powered by a ZDZ 40, Leo's entry is modeled after those Spitfires that chased down German V-1 buzz bombs during WW II.

the abCs of ADHESIVES

by the Model Airplane News *crew*

Everything you ever wanted to

Below: there are many glues out there; knowing what they are and how to use them properly makes our hobby much more fun!

A great variety of adhesives is available for modelers, and some work better with certain materials than others do. Certain glues are better suited to specific materials and structures within our various models. Balsa and plywood kits, fiberglass and composite aircraft and even the easy-to-assemble ARF kits all require different types of glue to complete their construction. Let's see what's out there!

GLUE TYPES

Glues are divided into two groups: single-part (you simply apply the adhesive directly from the bottle to the parts being glued) and two-part (two separate ingredients must be combined before the glue is applied).

Polyvinyl acetate (PVA), aliphatic resin, polyurethane, cyanoacrylate (CA) and epoxy are among the most popular, but there are, of course, many other types of structural adhesives available.

PVA and aliphatic resin have been around the longest. PVA (white glue) has been in use since the late '40s; Elmer's is the most common brand. Although it will bond any moisture-free, oil-free, porous materials, it has characteristics that make it less than ideal for RC modeling. PVA stays relatively soft and plastic, so structural joints secured with it will move over time. Its lack of moisture resistance makes it unsuitable for exposure to water. White glue is, however, a good adhesive for gluing small foam models together—if they won't be exposed to moisture.

Aliphatic resin (Titebond) was introduced in the early 1960s; Titebond-II is a more recent development. Aliphatic resin is good for almost anything we want to glue on a model. It's very water-resistant and sandable, and it has good gap-filling strength, fatigue- and shock-resistance.

It can be used to join small pieces of wood with little or no clamping pressure. Glue joints can be handled after 15 minutes, but they must be left overnight for the bond to reach full strength. After a reasonable shelf life of about two years (usually), it starts to thicken when it reaches the end of its useful life. Aliphatic resin has a relatively short working time—about 15 minutes—during which you can shift the parts into position. It can be thinned slightly and cleaned up with water, and it's the least expensive glue. Its only negative is that it dries from the evaporation of its water base and tends to shrink slightly (just as PVA does).

know about glue but were afraid to ask

Aliphatic resin has been around for a very long time. It is inexpensive, dries relatively quickly and is great for general wood structure assembly.

CA glues are available in various types and viscosities. Thick, medium and thin are the most popular types, and each is used for specific assembly tasks.

CYANOACRYLATE (CA)

CA glues are reactive monomers and are available in various viscosities: thick, medium and thin. They are compounds that form chemical links (that is, they polymerize) when spread or pressed into a thin film. The very small amount of moisture that's present on most construction surfaces acts as a catalyst for the adhesive to cure. When properly applied, CA forms a bond that is several times stronger than the materials that it joins. Too much moisture, however, will degrade the strength of the bond. The speed at which the bond is formed is the greatest advantage CA offers; you can build a model in hours instead of days and instantly repair damage at the field. When used with an accelerator (kicker,) thick CA can quickly fill in gaps caused by damaged or missing pieces. CA glues are also fuelproof.

CA USES

CA is great for general balsa and plywood parts construction. Because of its gap-filling properties, thick CA should be used on parts that don't fit together perfectly and when you join two different materials such as balsa and carbon fiber. Thin CA should be used on parts that fit tightly together but not to glue balsa sheeting together. The joint it forms is much harder than the surrounding balsa, and this makes it very difficult to sand the sheeting smooth; aliphatic resin would be best to use here.

CA STORAGE

CA's relatively long shelf life can be further extended if you store unopened bottles in a freezer or refrigerator. You should allow the glue to return to room temperature before you use it. Store open bottles in a cool dry place that isn't exposed to direct sunlight. Don't store your bottle next to your accelerator; over time, even the faintest of fumes will cause the CA to thicken and cure.

UNCLOGGING

To prevent clogs in the applicator tip, keep it away from any surface that has been sprayed with accelerator. When you finish using the glue, lightly tap the bottom of the bottle on the workbench to knock the glue in the applicator tip back down into the bottle. Give the bottle a little squeeze to blow air through the nozzle to clear it out completely, then wipe the tip clean with a cloth. If the tip does become clogged, don't use a metal pin to clear the tip. This will only push the clog down deeper into the bottle, and it will clog up again when you use the glue. Cut the clogged tip off the bottle, or use a thin, 1/16-inch bit to drill out the clog and form a new hole. A better way to prevent a clogged tip is to use an applicator tip extension. If it becomes clogged, you can remove the extension, clear it with a thin wire and then replace it on the bottle.

CA glue accelerators (kickers) speed the curing process. Keep it away from your glue bottle, though, or it will cause it to clog up.

What you need to know about CA

CA loses its potency if exposed to high temperatures for extended periods of time. Don't store CA in any areas that are exposed to summer heat, such as the car trunk, toolbox, or near a window. CA becomes thicker and darkens with age.

The only thing that can be added to thick CA to thin it is thin CA. Any other thinner will quickly harden the glue.

CA is non-toxic. CA fumes are vaporized cyanoacrylate monomers. They will irritate sensitive membranes such as the eyes, nose and throat. The moment the fumes touch the membranes, they are polymerized by body moisture and become inert. They never enter internal body systems. If you're sensitive to CA's fumes, try using odorless CA.

Use only odorless CA on white foam. Test accelerators for foam compatibility. Don't use too much accelerator on foam; it will generate excess heat when the CA cures and may cause the foam to melt.

Most CA has a shelf life of about one to two years. This can be extended by keeping it out of the sun and stored in a cool, dry place. Moisture shortens its shelf life; don't store CAs in very humid environments such as damp basements.

BONDING

To form a strong bond, the parts you are gluing need to fit together tightly. Smooth all rough spots on the mating surfaces and

always hold the parts together as tightly as possible while you glue them. CA will hold objects together with considerable strength within seconds; however, it will take several hours for the bond to reach full strength. Although accelerator greatly shortens CA's cure time, the bond will be stronger if you allow it to cure naturally.

For superstrong CA glue joints, make sure that your parts are held tightly together, and allow the glue to penetrate deeply into the joint. For poorly fitting joints, a gap-filling CA is a better choice than several layers of thin CA. When in their cured state, thick CA glues are less brittle than thin CA is, and in general, "odorless" CA is about 10 to 15 percent weaker than regular CAs.

CA glue gives off strong vapors when it cures, so use it in a well-ventilated room that allows plenty of airflow over your building surface. Some modelers have developed allergic reactions or have become sensitive to CA vapors—including the "odorless" variety. CA readily bonds skin to just about everything, and even experienced modelers will glue their fingers to a model from time to time. That's why there is CA debonder.

Odorless CA is also safe for foam use.

How do you remove unwanted CA bonds? With debonder/remover! It may take several applications, but this material will slowly remove unwanted CA.

Containers and applicators; two-part epoxy must be mixed together for it to cure. Disposable mixing cups, 35mm film containers and Post-It notes are great for keeping the mess off your workbench. Old plastic syringes are great for neatly applying single-part glues to tight places.

Helpful CA tips

CA can be used to harden screw holes in wood. Remove the screw from the threaded hole, apply thin CA and let it cure. Thread the screw back into the hole.

Saturate the wooden trailing edge of the wing where rubber bands are used to secure it to the fuselage. After the glue has cured, sand it smooth before you cover it.

Repair a cracked canopy with CA. Squeeze the crack shut, apply tape to the inside surface and wick thin CA into the break. Sand the repair with some 600-grit wet/dry sandpaper and soapy water, then polish it with metal polish.

To hold down flexible pushrod tubing in the fuselage, wrap a pipe cleaner around the tube and cut the loose ends off. Press it against the fuselage's inside surface and apply thin CA. The capillary action will saturate the pipe cleaner, and it will stick to the balsa and tubing.

To keep the ends of a string from fraying, saturate them with thin CA.

Use thick CA and accelerator to build up layers of glue to replace or reinforce broken plastic parts.

Use flexible CA to prevent rubber tires from slipping off the rims.

To reinforce joints, use fiberglass cloth over the joint and apply thin CA. Capillary action will saturate the fiberglass and bond it tightly to the joint.

To apply accelerator in small amounts, fill a clean, empty CA bottle with accelerator and attach a fine CA tip to dispense it one drop at a time

To repair cracked or damaged fiberglass parts, use thin CA on the inside of the damaged area. The CA will wick into the fibers and harden; then apply a bead of thick CA and spray it with accelerator.

Use thin CA to seal up the end grains before you paint. CA is a great wood sealer and prevents the paint from soaking into the pores.

After sanding off the finish to balance a prop blade, use thin CA to fuelproof the area. Wrap your finger in a small plastic bag, and rub the CA into the wood. This adds almost no weight.

If you add a drop of CA to a steel cable before you cut it, its cut ends won't unravel.

Some hobby materials—foam, for example—are not compatible with CA; you must use a special "foam-safe" CA to bond it.

EPOXY

Epoxy resin is a thick adhesive that's packaged in two parts that have to be mixed together before the adhesive will cure. Part A is the glue base, and Part B is the hardener (catalyst). Most epoxies require equal parts of A and B, but the ratio isn't super-critical. You can "eyeball" the two amounts, and the epoxy will still cure properly. There are other types of epoxy that must be mixed in unequal proportions (2:1 or 3:1 ratios) that require mixing cups to get the ratios correct. Being thick and very sticky, epoxy does not run as easily as CA adhesives do.

Two-part epoxy resin costs about a quarter of CA's price, so it's much more economical to use, especially for large areas. Epoxy (1:1 ratio) is very easy to use, and in general, allergic reactions to this adhesive are rare. Epoxies can be used to bond most materials together, but you must first roughen the surfaces a little. You can easily bond foam with epoxy, and a wide range of cure times—from 5 minutes to 4 hours—is available to give modelers plenty of time to align the parts that they bond.

MIXING

When you mix epoxy, any paper scratch pad or scrap piece of flat material can be used as a palette. A plastic coffee-can lid makes a great mixing surface because of its raised outer border, and as it's a flexible material, it is easy to peel cured epoxy off it. In cooler temperatures, if the epoxy becomes thick and difficult to pour out, you can microwave it (for about 10 seconds on high); warm epoxy flows more easily.

To mix epoxy, squeeze out equal lengths of parts A and B next to each other, and use a Popsicle stick or other piece of scrap to mix them together thoroughly. Roughen up the surfaces to be epoxied with 100- to 120-grit sandpaper to give the epoxy something to grip. If you want a thinner mixture to pour into a tight space, thin the epoxy 15 to 20 percent with isopropyl alcohol.

As with CA, slower-setting epoxy produces a stronger joint because it can penetrate deeper into the pores of the wood. As a rule, if you have a 5-, 15- and 30-minute epoxy, the 30-minute epoxy's bond will be the strongest when it's cured. However, an extra-slow-curing epoxy (2-hour, for example) isn't any stronger than 30-minute epoxy. It only gives you more working time before the adhesive thickens and cures.

For this reason, don't use 5- or 10-minute epoxy to glue wing halves together! It will cure before you cover all the mating surfaces. Take your time and use 30-minute epoxy!

Epoxy is excellent for laminating two or more pieces together, especially parts that are subject to high stress and vibration. Landing-gear blocks and firewalls are two

Specialty Glues

CA GELS. Thick CA adhesive that can fill very large gaps and stays where you put it. Will not run. Has a longer cure time, but can be used with accelerator. Great to have in the field box for quick repairs.

CANOPY GLUE. Medium-viscosity glue developed specifically to bond clear-plastic canopies and other plastic parts to just about anything else. Remains flexible after it has dried and turns clear to minimize blemishes left on windshields or windows.

FIBER POXY. Two-part, thickened epoxy paste designed specifically for bonding parts to fiberglass. Comes in twin-syringe applicator. Excellent for bonding bulkheads inside fiberglass fuselages.

FINISHING RESIN. Ideal for applying fiberglass cloth to wood sheeting, this epoxy glue remains flexible after it has cured. Sets up quickly, is waterproof, and sands easily without loading up the sandpaper.

FLEXIBLE CA. Excellent for use on fiberglass, carbon fiber, or any other materials that need to flex a little during normal activities. Remains flexible after it has cured and can withstand tremendous physical shock and stress. Extremely moisture- and solvent-resistant.

HINGE GLUE. As the name implies, this was developed specifically for gluing plastic hinges into wood structures. Bonds to virtually all types of plastic hinges and holds them tight. Easy cleanup with water.

POLYURETHANE GLUES. Strong and versatile, polyurethane glues foam up and stick very well to everything. Completely waterproof when dry. It expands and fills gaps as it dries. Requires clamping because of the way it expands. A little goes a very long way. Soap and water cleanup before it dries. Long working time.

SPRAY ADHESIVE. Available in aerosol cans, spray adhesives are great for bonding large flat sheets together and bonding balsa sheeting to foam-cores. Apply a light mist to each surface and then press the dried surfaces together. Can also be used to tack fiberglass cloth into place before you apply finishing resin.

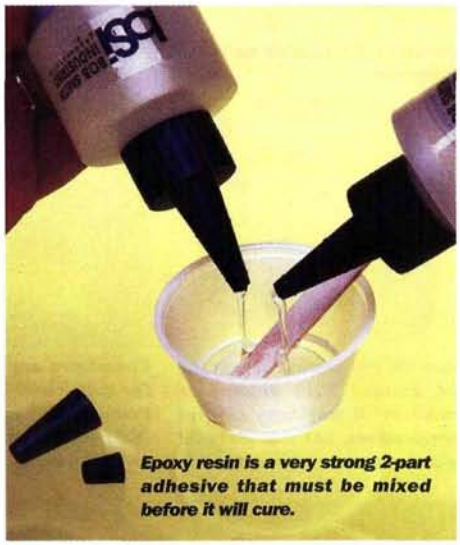
THREAD-LOCK COMPOUND. For use with any metal bolt or screw threaded into a metal nut or base. Prevents nuts and bolts from vibrating loose while it allows their easy removal with hand tools. Should not be used with screws that thread into plastic parts.

ZAP-A-DAP-A-GOO/PFM. These all-purpose, thick, silicone adhesives bond readily to just about anything and remain very flexible when they are dry. Easy to cut and remove after they've cured. Great for sealing a fuel tank or fuel lines into place. Will dissolve white foam.

main areas where epoxy is the best adhesive to use. Slow-setting epoxy is ideal for gluing the horizontal stabilizer and vertical fin to a fuselage. The slower curing epoxies allow you plenty of time to line up the tail feathers with the fuselage. The excess epoxy that oozes out of the joint is easy to clean off with paper towels and rubbing alcohol.

Epoxy's main disadvantage is its weight. The resin doesn't evaporate while it cures, so what you apply is what's left on the parts. Use it sparingly; extra epoxy adds only weight—not strength.

Some of the quicker-setting epoxies aren't resistant to long-term exposure to raw nitro fuel or water, and ambient temperatures also affect cure times. Cold weather lengthens the cure time; warmer weather will hasten the curing process. Always mix epoxy resin according to the instructions. If you add too much part B, it may never fully harden, or it may become extremely brittle and lose a great deal of its bonding strength.



Epoxy resin is a very strong 2-part adhesive that must be mixed before it will cure.

Some epoxies are mixed in a 1:1 ratio, but others require different ratios; epoxy that's mixed 2:1 comes in bottles of different sizes. Always read the directions before you mix epoxy.

Specialty glues are designed for specific building jobs. They all work well if you use them for their intended purposes.

FINAL THOUGHTS

Don't get stuck with the wrong glue! The more you know about the vast array of adhesives available the easier it will be for you to properly build your models. They'll last longer, and you'll get more fun out of our hobby. ✈

Bob Smith Industries *(805) 466-1717; bsiadhesives.com.*

Built-It Epoxy; *distributed by Tower Hobbies (800) 637-4989; towerhobbies.com.*

Cyberbond *(630) 761-8900; cyberbond1.com.*

Kwik Bond; *distributed by Global Hobby Distributors (714) 963-0329; globalhobby.com.*

PFM; *distributed by Hobby Lobby Intl. (615) 373-1444; hobby-lobby.com.*

Pro Epoxy; *distributed by Great Planes Model Distributors (217) 398-6300; (800) 682-8948; greatplanes.com.*

Sig Bond; *distributed by Sig Mfg. Co. Inc. (800) 247-5008; (641) 623-5154; sigmfg.com.*

Titebond II; *distributed by Franklin International (800) 877-4583; titebond.com.*

Zap; *distributed by Pacer Technology (800) 538-3091; pacertechnology.com.*


NAVY
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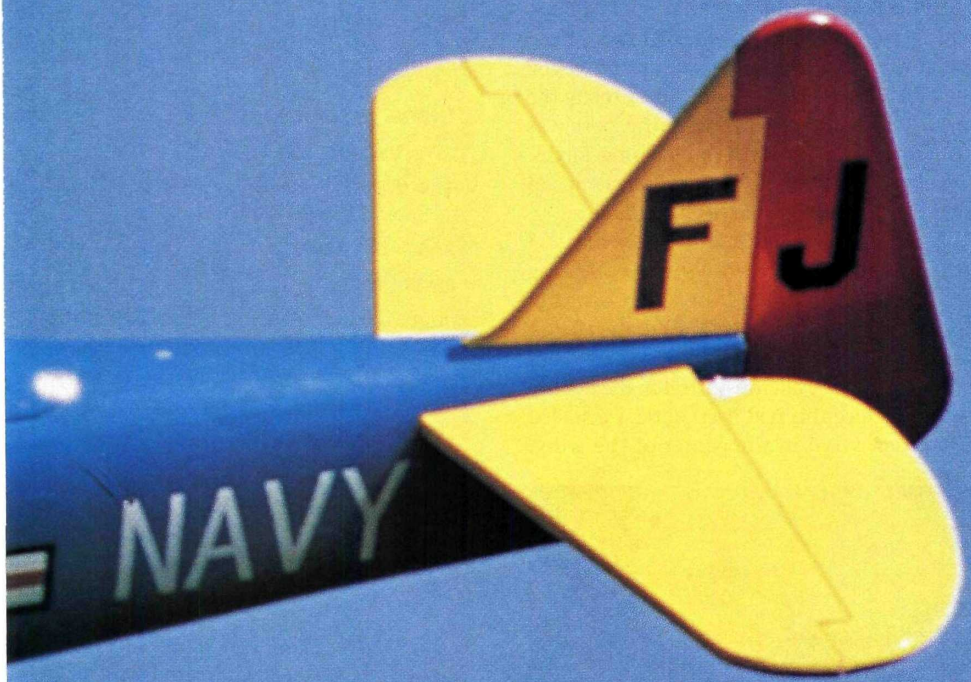
HANGAR 9

AT-6 Texan ARF

by George Leu



A .60-size sport-scale warbird with retracts!

I have always considered myself a kit builder, and I especially like to build scale airplanes. The distinctive shape of the AT-6 Texan is one I hadn't thought would lend itself well to being duplicated in ARF form. The new ARF Texan from Hangar 9, however, amazes me! It just doesn't look like an ARF that takes only a few hours to build. Hangar 9 got this one exactly right! If you've ever had any doubts about buying a prebuilt model, check out the Hangar 9 Texan. It made a believer out of me!

IN THE BOX

I was impressed with the packaging and the individually wrapped parts and pieces. The UltraCote covering was virtually wrinkle-free, and all the scale markings were already in place. The wing center section was the kit's most surprising part because the mechanical retracts come already installed and ready to operate. All I had to do was install a servo and connect the linkage. When I plugged everything in, the gear functioned properly without any binding.

The Hangar 9 kit comes with a very complete hardware package that includes the fuel tank, pushrods, wheels, cockpit interior, a dummy radial engine, a 55-page assembly manual and a beautifully painted cowl. All the control surfaces come prehinged from the factory, adding another nice touch to an impressive kit. A correctly shaped wing fillet is built into the fuselage, and a pair of factory-painted wing-joint fairings is also included. The greenhouse canopy even comes with the framework already painted. In all, the Texan is a very impressive package.

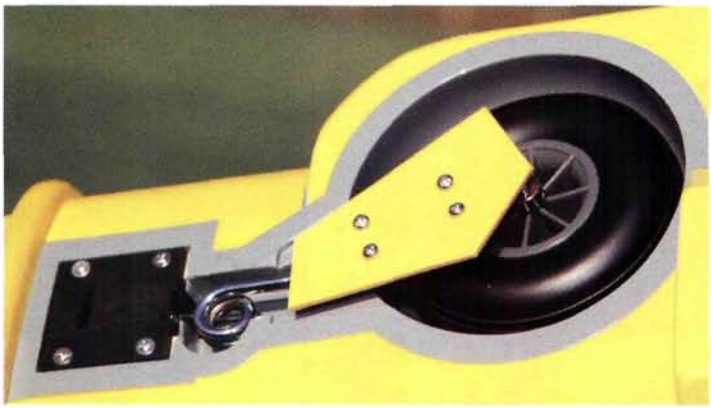
I started checking the parts fit by dry-fitting the wing spars and the wing panels (without glue), and everything fit together perfectly. The wing's fit to the fuselage was also perfect. With a wood kit, you could spend a fair amount of time fitting these two parts together and still not get as good a fit. In about one minute, I had fitted all the model's parts together without any trimming or sanding required anywhere. This certainly motivated me to start gluing parts together.

ASSEMBLY TIME

The assembly manual is well written and illustrated, and I followed it completely to build the kit. The first step is to glue the hinges into the wing and ailerons with thin CA. Then I assembled the three wing sections using slow-setting epoxy. While the glue dried, I placed the entire wing on my bench and measured the dihedral at each tip. Both were exactly the same. The most time-consuming part was installing the wing-panel-joint fairing pieces. It took a little tape and some spring clamps to hold them in place while the glue dried.

After the glue had completely dried, I installed the aileron servos (one in each wing panel) and then screwed the aileron control horns into place. Before you install the aileron pushrods, make sure that the servos are centered and that the ailerons are set in the neutral position. Once this had been done, I installed the retract servo in the center of the wing. Since the pushrods driving the mechanical retract were already installed, this takes only a few minutes. I spent about an hour at the bench, and the wing was completely finished!

The next step is to install the wing-alignment dowels in the leading edge and the wing-attachment blind nuts in the predrilled holes in the plywood attachment plate in the aft section of the wing saddle. Attachment holes are already drilled in the wing's trailing edge, and you must glue the reinforcing plywood strip over the holes. Using the attachment holes as a guide, drill ¼-inch holes through the plywood strip, and then bolt the wing to the fuselage. Once the wing is in place, measure the distance from the tail to each wingtip and make sure that both measurements are the same. If they aren't, enlarge the attachment holes so you can adjust the wing accordingly. After



Top left: there is plenty of room in the Texan for any radio gear; I used JR's. Top right: the steerable tailwheel assembly is attached to the bottom of the fuselage with a bracket for added strength. Bottom left and right: the great thing about the Texan is that its retractable landing gear comes already installed for you. You have to attach the gear doors, though.

SPECIFICATIONS

MODEL: AT-6 Texan

DISTRIBUTOR: Horizon Hobby

TYPE: ARF

MANUFACTURER: Hangar 9

WINGSPAN: 67.5 in.

WING AREA: 706 sq. in.

WEIGHT: 8 lb.

WING LOADING: 26.1 oz./sq. ft.

ENGINE REQ'D: .60 to .78 2-stroke or .65 to 1.00 4-stroke

ENGINE USED: Webra .61

FUEL USED: Cool Power 15%

RADIO REQ'D: 5-channel (rudder, throttle, elevator, aileron, retracts)

RADIO USED: JR PCM

PROP USED: Zinger 13x5

PRICE: $254.99

FEATURES: all wood construction; factory-built fuselage, three-piece wing and tail surfaces; painted engine cowl and canopy; formed dummy radial engine and other scale accessories; engine mount; fuel tank; basic nuts and bolts; wheels; tailwheel assembly; factory-installed retractable main landing gear; UltraCote covering; a photo-illustrated instruction booklet.

COMMENTS: the Hangar 9 AT-6 Texan is an easy-to-build .60-size sport-scale warbird that flies great. Its assembly manual is well written and features many photos to guide you through construction. The included engine mount is slotted, allowing you to use a wide range of engines to power the model. Though I build mostly wooden kits, this ARF has made me a believer.

HITS

- Excellent instructions.
- Great parts fit.
- Very good construction quality.
- Great flight performance.
- Comes with retractable landing gear already installed.

MISSES

- Landing-gear struts became loose and rotated inside the retract mechanism.

The Mighty Texan

It could be argued that the AT-6/SNJ Texan was the most important U.S. aircraft of WW II. It is big, noisy and can be cantankerous on occasion, but once a student has mastered the Texan, every other airplane from the Mustang on down is a walk in the park. It took a green student and made a real pilot out of him. That's why the U.S. was so successful putting pilots with less than 200 hours' total time into combat: their Mustangs and Hellcats were so much easier to fly than the Texan that, in nothing flat, they were at home in their new mounts.

Once it's spinning, it's as stable as a house and asks only that you get full opposite rudder and forward stick to recover. No big deal; just like any other airplane, right? Wrong! As it stops rotating, where most airplanes would allow you to bring the nose up, in the Texan, you have to show more than a little patience; pull a little too soon, and you'll find yourself in a secondary stall and spinning in the other direction. Take your time. Let it accelerate for a few seconds, and then start the nose up.

Landing the airplane can make a real believer

As trainers go, the Texan could easily be the best one ever built. Except for the numbers on the airspeed indicator, it feels exactly like you're flying a WW II fighter in slow motion. It also mimics the worst habits a young pilot would ever see in the faster, heavier combat aircraft.

In the air, the airplane can dance with the best of them and is a joy to do big, swooping aerobatics in. But it has its dark side, and that's one of the factors that makes it such a great trainer. It's absolutely unforgiving when slow. Pull just a little too hard at any given speed, and it will stall and snap out (usually to the right) with practically no warning. It's the rare Texan pilot who attempts his first loop without stalling out on top only to have the airplane arc around in a majestic, slow snap roll as it rolls right-side up and then tries to continue into a spin.

of you; it's critical that you keep the tail behind the nose and kill all crosswind drift prior to touchdown. Hit a little crooked or let the tail start around on you, and your legs suddenly seem too short, too weak and too slow. Get it on straight, and it's a real gentleman. Let it get crooked, and it definitely isn't a gentleman. That narrow gear and high CG are just made for exciting ground handling.

Still, it isn't a dangerous airplane. Yes, it has its demanding characteristics, but it will do the same thing the same way every single time, and that is the mark of an honest airplane. It challenges its students just enough to force them to grow without beating them down. And that's the mark of a great teacher; and 60 years later, it's still the only pipeline into a fighter.

—Budd Davisson

the wing has been properly aligned with the tail, install the horizontal stabilizer.

Remove the covering from over the stabilizer slot, and slide the stab into place. Center it in the slot, and measure from the tips of the stab to the wingtips. The distance on each side should be the same. It should also be parallel with the wing when viewed from behind. When the stabilizer is in the correct position, use a pen to mark it where it comes out of the fuselage slot. Remove the unwanted covering from the stab's top and bottom, and glue it back into place with epoxy. Check its alignment with the wing, and let the epoxy cure. Install the vertical fin, and make sure that it's square to the stab. Use tape to hold it in position until the epoxy has cured.

Before you can hinge the elevator halves to the stab, you must install the wire elevator joiner. Mark the joiner's position, and then drill holes and cut slots in the elevator's leading edges. Slip the joiner through the aft fuselage, then epoxy it into the elevator halves and glue the hinges into place with thin CA.

Before you glue the rudder hinges into place, you must attach the tailwheel assembly to the rudder. Drill a hole in the leading edge, then slip the tailwheel wire into place. Glue the hinges into place, and then screw the tailwheel attachment bracket to the bottom of

... this AT-6 Texan from Hangar 9 is hard to beat.

the fuselage. To finish the tail surfaces, locate the positions of the control horns, and screw them into place on the rudder and elevator.

Installing the stabilizer, fin, elevators and rudder was very easy using the procedures in the manual. If anything, I felt as though this entire plane was an assembly exercise rather than a building one. Maybe that's why they call it an "assembly" manual.

ENGINE AND FUEL SYSTEM

The engine-mount attachment holes in the firewall are elongated so you can install the blind nuts to fit your choice of engine and mount. Attach your engine to the included engine mounts (I used a Webra .61 2-stroke), and measure the distance between the engine-mount attachment holes. Mark the measurement on

The aileron servo is under a flush hatch just in front of the control surface.

the firewall with a pen. Use an attachment bolt and a washer to pull each of the blind nuts into place and secure them with thin CA; make sure that you don't get any glue in their threads.

A long slot in each engine-mount beam allows you to slide the engine forward and aft to adjust the engine's position. The distance from the firewall to the prop's drive washer should be 5½ inches. Once you have

FLIGHT PERFORMANCE

TAKEOFF AND LANDING

The Hangar 9 AT-6 is not at all difficult to fly, but having some tail-dragger experience will be very helpful. Though it looks great, the retractable landing gear tends to allow the model to rock from side to side. This is most noticeable during crosswind takeoffs and can cause a wingtip to drag on the ground.

Advance the throttle slowly, and be ready to feed in as much right rudder as necessary to keep the model going straight down the runway. The AT-6 has no tendency to nose over during the takeoff roll, but use up-elevator to keep the tailwheel on the ground until some speed has built up. As you ease off the up-elevator, the model will be airborne in about 40 feet. Takeoffs are very scale-like, and the AT-6 sure looks good during climb-outs!

During landing approaches, the model tends to slow quickly, so you need to hold in a little throttle during final approach. The control response during landings remains very solid, which is a good thing. During the first landing, I slowed the model down too much, and it started to tip-stall. A quick blip of the throttle and some control inputs had the AT-6 swiftly back in the groove. Unless you fly from a paved runway, 3-point stalled landings are the way to go. On my thick grass runway, the model nosed over on the first landing. The next landing was much better, as I timed the up-elevator input with touchdown, and the model rolled out nicely.

LOW-SPEED FLIGHT

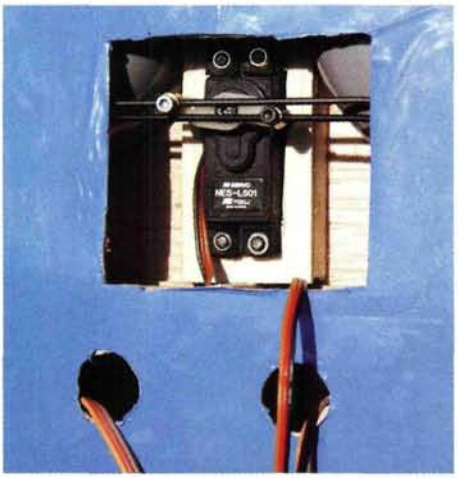
Since this is a scale model of a military trainer, the slow-flight handling of the AT-6 is wonderful. As noted, the model can tip-stall, but only if you attempt to fly it extremely slowly. Cruising around at ½ throttle, the AT-6 is very comfortable. Once slowed down and made to stall, the plane showed no nasty snapping habits. Each time I stalled it, it would drop a wingtip, gain speed and keep on flying. Pretty good for a warbird!

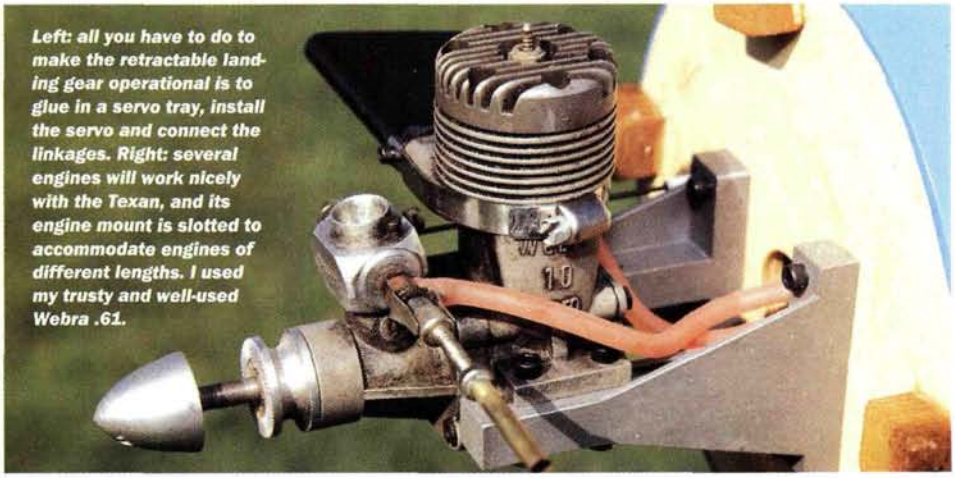
HIGH-SPEED FLIGHT

The full-scale AT-6 is not a speed demon, and the model with the Webra .61 mimics its larger cousin. In fact, the .61 is well suited to it, as it flies the model at a relaxed scale speed—perfect for practicing scale flybys.

AEROBATICS

Whichever maneuvers the full-scale Texan can do, the model can do also. The only thing missing is the growl of the Pratt radial engine. In the air, the model tracks very well, and with a slight rudder input coupled to the ailerons, it makes very nice turns. Rolls are a little slow on the recommended rates, but they look just like the real thing. Loops are oh-so-graceful and just fun to watch as the plane floats over the top. Point rolls and knife-edge flight require timed rudder inputs for maximum performance. The AT-6 spins and snaps well and has a tendency to "wind up" as it gets deeper into the maneuver. The model also flies well inverted, but you'll need to hold some down-elevator to keep it level. This is a great warbird for the Sunday flier!





Left: all you have to do to make the retractable landing gear operational is to glue in a servo tray, install the servo and connect the linkages. Right: several engines will work nicely with the Texan, and its engine mount is slotted to accommodate engines of different lengths. I used my trusty and well-used Webra .61.

the engine in the correct position, install the throttle linkage and the fuel tank.

RADIO AND FINAL ASSEMBLY

Glue the servo tray into place, and then install your servos, battery pack and receiver. Wrap the radio equipment with foam rubber to protect it from vibration. Wooden dowels are included for the rudder and elevator pushrod, and threaded pushrod wires are used to form the ends. I used an L-bend and a keeper to attach the pushrods to the servos and the included plastic clevises to attach the pushrods to the control horns. A threaded brass connector is included to attach the throttle-linkage wire to the throttle servo. I used a JR PCM radio and JR servos throughout.

Before I screwed the canopy into place, I added a little life to the cockpit interior with a Great Planes pilot figure. You can add several other scale accessories included in the kit to improve the model's already great looks. All that's left to finish the Texan is to glue the dummy radial engine inside the engine cowl, trim the cowl to fit the exhaust system and the needle-valve extension, and then screw the cowl into place.

My AT-6 balanced slightly nose-heavy at 4¾ inches from the leading edge of the wing, right at the suggested balance point for the first flight. Nothing left to do but charge the batteries and then head to the flying field!

Before I headed out, I noticed that the landing-gear strut wires were loose and could be rotated within the retract unit. A setscrew in the rotator block holds the strut wire in place. If your gear struts are loose, remove the retract units from the wing, check the alignment of the landing-gear axles, and then tighten the setscrews. Apply a little thin CA where the strut wire exits the rotator block, and reinstall the retracts. A simple fix.

FINAL THOUGHTS

If you are looking for documentation, the Hangar 9 Texan is modeled after a full-scale AT-6 owned by Fred Johnson of Ocala, FL. Its brilliant yellow, orange and blue paint scheme is ideal for high visibility. The model has good proportions, builds very quickly and is a great low-pressure flyer that just happens to be a warbird. If you want a fast ticket for your next warbird meet, or you just want to turn a few heads at the local flying field, this AT-6 Texan from Hangar 9 is hard to beat! I highly recommend it.

Cool Power; distributed by Morgan Fuel; (800) 633-7556; morganfuel.com.

Great Planes Model Distributors; (217) 398-6300; (800) 682-8948; greatplanes.com.

Hangar 9; distributed by Horizon Hobby Inc.

Horizon Hobby Inc. (800) 338-4639; horizonhobby.com.

JR; distributed by Horizon Hobby Inc.

Webra; distributed by Horizon Hobby Inc.

Zinger; distributed by J&Z Products; (310) 539-2313; zingerpropeller.com.

Speedy e-powered performer

For years, modelers have been impressed by the flight performance of the Great Planes all-balsa ElectroStreak kit, and now, this almost-ready-to-fly version with its molded fiberglass fuselage provides an excellent introduction to aerobatic flight for electrics pilots who have experience with park flyers.

GREAT PLANES

PHOTOS BY DAVE GARWOOD

Electro

Streak ARF

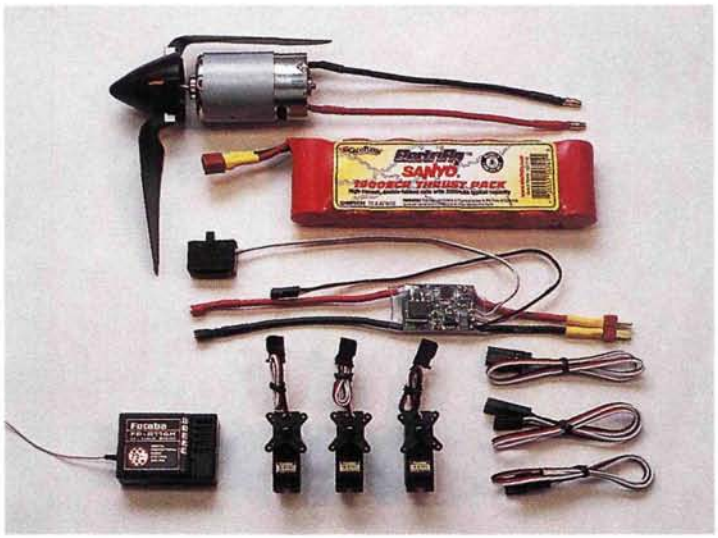
by Dave Garwood

The kit contains almost everything you'll need to build the model except adhesive. Note the molded, painted fuselage, the precovered wing and tail surfaces, the motor, ESC, folding propeller with spinner and bags of hardware and small parts. To fly, you'll need a receiver, 3 servos and a battery pack.

IN THE BOX

The box contains a fiberglass fuselage with a plywood motor-mount plate with wing hold-down nuts installed and covered and decorated wing halves and tail surfaces. Supplied equipment includes a 550 "can" motor, a folding propeller and spinner, an electronic speed control (ESC) for the motor and all the small parts and hardware needed to build the airplane.

The comprehensive 24-page instruction manual is illustrated with 57 photographs and 13 drawings, and it covers preparation, building and setup for flying. Through Great Planes' terrific phone- and Web-based product support, even inexperienced builders will have access to all the information needed to finish the assembly.



The onboard gear used to build this plane includes a motor, a folding propeller with spinner, an ElectriFly 1900mAh, 7-cell battery pack, an ESC with a Deans Ultra Plug connector attached, a Futaba FP-R114H receiver and 3 Futaba S-3101 servos. You'll need the three 6-inch servo-extension cables if you mount the receiver in front of the battery; you won't need them if the receiver is mounted behind the battery.

To complete the ElectroStreak and prepare it for flying, you'll need a transmitter, a receiver with a minimum of 4 channels, 3 microservos and at least one 7-cell battery pack. If you have more than one flight battery pack, you'll be able to fly while your batteries are cooling (or charging). Depending on where you mount the receiver (in front of or behind the battery pack), you might need three, 6-inch servo-extension cables. You'll also need epoxy and CA.

CONSTRUCTION

Begin by ironing down all the covered surfaces with a covering iron as instructed, and then drill hinge holes (the slots are already cut) and install the ailerons with thin CA. During your next building session, join the wing halves with epoxy and let the wing cure overnight. Then fit the aileron servo, install the aileron control linkage and bolt the wing to the fuselage to test the fit.

Fuselage construction consists of

SPECIFICATIONS

MODEL: ElectroStreak ARF

MANUFACTURER: Great Planes Model Mfg.

TYPE: high-performance electric sport airplane

WINGSPAN: 44.5 in.

LENGTH: 39.5 in.

WING AREA: 342 sq. in.

WEIGHT: 44.8 oz. (with 7-cell, 1900mAh battery pack)

WING LOADING: 18.86 oz./sq. ft.

MOTOR INCLUDED: 550 "can"-type

SPEED CONTROL INCLUDED: Great Planes ESC with BEC

PROPELLER INCLUDED: 7.9x5-in. folding, with spinner

BATTERY USED: 7-cell, 1900mAh ElectriFly

RADIO REQ'D: 4-channel (ailerons, elevator, rudder, ESC)

RADIO USED: Futaba Attack-4 transmitter, Futaba FP-R114H receiver and 3 Futaba S-3101 microservos

PRICE: $129 (includes motor, prop, spinner and ESC)

FEATURES: exceedingly clear and detailed instruction manual; molded, painted and finished fiberglass fuselage; wings and tail parts are built, covered and decorated; pull/pull rudder linkage is designed to save weight in tail; motor, prop, control cables and hardware are included.

COMMENTS: this is a good-looking, quick-building, low-cost yet high-performance electric-powered airplane with solid and predictable flight performance. It provides an excellent introduction to aerobatic flight for experienced electric-power pilots who have flown park flyers.

HITS

- Quick and easy to build.
- Exhilarating flight performance.

MISSES

- Cooling intake is provided, but cooling outlet is not.
- Builder must be careful when fitting control linkages to prevent the aileron linkage from interfering with the rudder linkage.

assembling the servo tray from the parts supplied and installing the servo tray, the battery tray, the pushrod control cable for the elevator and the pull/pull cables for the rudder. Although epoxy is specified for this, I prefer to use Goop household adhesive; this glue delivers a more resilient grip than epoxy for parts that may flex or suffer hard landings. Last, glue on the horizontal stabilizer with epoxy and the vertical stabilizer with Goop, and set up the elevator and rudder linkages.

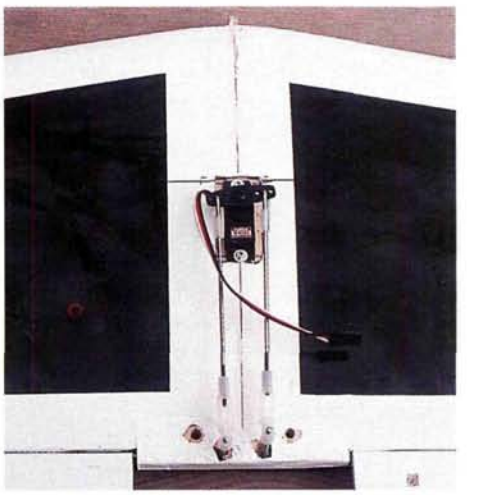
Two areas are problematic, but both are easy to solve. First, there's a close fit between the aileron linkage and the rudder servo arm. If you mount the fuselage servos in the spot suggested in the instructions (i.e., slightly forward and easier to reach), these parts won't interfere with each other, but the receiver must be mounted up front, and this means that you'll need the three servo-extension cables. If you mount the fuselage servos as shown in the photos (i.e., slightly rearward, and more troublesome to reach), you may incur interference, but the receiver can be mounted behind the battery, and servo-extension cables won't be needed. I ended up shortening the aileron linkage torque wires a little to get mine to fit in the rearward location.

Second, the hole in the rear bulkhead is too small for the elevator pushrod tube to fit through; it must be enlarged with an extended drill bit. My bulkhead cracked and fell out during this operation, and I left it out to provide an outlet for the heat produced by the motor and battery pack; this is extremely important for motor system efficiency and longevity. I used Goop to glue in a small balsa block to keep the rear of the pushrod aligned with the elevator control horn.

The last step is to install the motor, ESC, on/off switch and receiver. The instructions cover this thoroughly, and the only additional tip here is to use hook-and-loop fastener to mount the ESC and the receiver; the stuff does an excellent job. The motor and switch are mounted with small machine screws. The instructions suggest that you upgrade your battery connectors. I installed Deans Ultra connectors, as they are compatible with my charger and test equipment. I soldered the ESC directly to the motor terminals to eliminate the push-on connectors, but you can complete the airplane without doing any soldering, if you like. From opening the box to being ready to fly, I spent 8½ hours on the project.

... the ElectroStreak is predictable and well-behaved in flight ...

Join the wing halves with the parts inverted and then weight the wing down flat on the workbench. The wing will then be flat on top with a slight dihedral effect that is equal to the taper of the bottom of the wing.



Here, the aileron servo and linkage have been mounted on the underside of the wing. Note the black MonoKote that I applied to the wing's white underside; it makes the plane easier to see in the sky.

FLIGHT REPORT

The ElectroStreak flies very well indeed—not surprising for a plane whose basic design has been in production for many years. Great Planes rates the flying skills needed as "intermediate," and I agree. The ElectroStreak is predictable and well behaved in flight, but since it does not right itself automatically when you release the sticks, it should not be considered a trainer. It's designed for those who know how to fly RC and who perhaps already have a few slow flyers and park flyers under their belts and are ready to go fast.

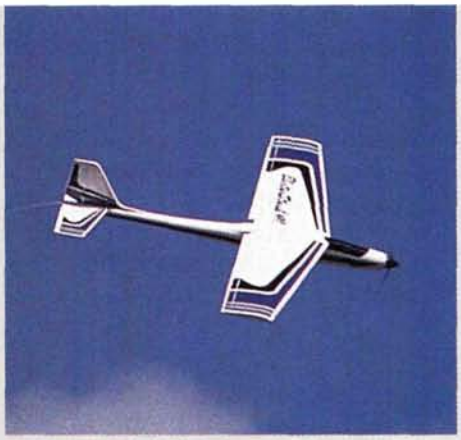
The most important thing to remember when launching the plane is to release it with a strong throw—aimed at the horizon—at full throttle. Don't give it a halfhearted throw or aim it upward, as this may cause it to sag into the ground or climb weakly and stall. Once it gathers some airspeed, the ElectroStreak is stable and predictable, and when trimmed, it often requires no stick input until you're ready for your first turn (because the plane is becoming too small to see!). Make a broad, climbing turn, swing past the launch point and enjoy its speedy flight performance.

Gain some altitude and try some rolls: slow rolls, point rolls, fast rolls. When inverted, add a dab of forward stick to keep it axial. Big loops look beautiful; small loops make your heart pound. For me, the ElectroStreak is in its element when it's flying through Cuban-8s, Immelmann turns and split-S's. The plane handles all these maneuvers in fine form.

You'll get a chance to use your left thumb, adding just a little rudder to coordinate the flat turns or banging it over for a hammerhead stall turn.

I made a simple battery substitution that saves more than 5 ounces in RTF

FLIGHT PERFORMANCE



TAKEOFF AND LANDING

Launch the ElectroStreak with a vigorous throw and with full power applied. The pilot or launch helper must throw the plane forcefully, aiming it toward the horizon—not upward. Let the plane fly level (or even descend slightly) for a few seconds to allow it to reach flying speed. When it reaches full speed, pull back on the elevator stick gently; the plane will climb quickly and positively.

The ElectroStreak will glide for long distances, so to avoid obstacles, line up for landing with plenty of clear field available. Keep the wings level and let the model descend in a flat glide until it meets the ground. Cutting power to zero allows the propeller to stop and fold and protects it from damage.

GENERAL FLIGHT CHARACTERISTICS

The ElectroStreak is quick, and pilots who are used to flying park flyers may be surprised by how much sky it covers in a short time. After the plane has reached a comfortable cruising altitude, the power can be cut back to 60 to 75 percent, and it will maintain its altitude. The model has superb stall characteristics. Reduce the throttle and pull up a little, and the ElectroStreak mushes along well under control, strongly resisting the stall. Pull up harder, and although the nose finally falls, the model maintains its heading and regains flying speed after falling about 10 feet. Aileron and elevator controls are mild and smooth, and rudder control is strong; only slight rudder deflection is needed to achieve a beautifully coordinated turn. All in all, this is a well-behaved airplane.

AEROBATICS

Aerobatics is what this plane does. Large and small loops are easy and pretty to watch. The roll rate is subdued—about 270 degrees per second—and an axial roll requires some forward stick halfway through the roll to hold the nose up. Inverted flight is solid, and with the elevator stick about half forward, the ElectroStreak will fly inverted for as long as you care to—including inverted turns. It easily performs loops, rolls, hammerhead stall turns, Immelmann turns, split-S's, Cuban-8s and reverse Cuban-8s.

Notice the location of the onboard components with the receiver mounted behind the battery. For this to work and for the plane to balance correctly, you must mount the elevator and rudder servos as far back as possible. I deviated from the instructions here but didn't experience any radio interference.

Glue the vertical fin to the fuselage with Goop, and hold it in place with tape while the Goop cures.

weight and noticeably increases the airplane's flight and aerobatic performance. My ElectroStreak weighs 44.8 ounces with the Great Planes 7-cell, 1900 SCR pack for a wing loading of 18.86 ounces per square foot. Substituting an SR Batteries 7-cell, 1200 MAX pack drops the RTF weight to 39.5 ounces and a 16.63-ounce-per-square-foot wing loading. With the SR pack, my ElectroStreak launches more easily, climbs with much greater authority, loops more tightly and generally responds more quickly and more positively to control inputs. For me, it's more fun to fly with the lighter SR 1200 MAX pack, even though the heavier Great Planes 1900 SCR pack gives longer flights and more stability in gusty conditions. Lucky pilots have a pair of each type!

The ElectroStreak is a well-behaved airplane with a wide spectrum of flight performance, and it's available in a highly prefabricated kit at a righteous price.

ElectriFly; *distributed by Great Planes; electrifly.com.*

Futaba Corp. of America; *distributed by Great Planes; futaba-rc.com.*

Great Planes Model Mfg. Co.; *distributed by Great Planes Model Distributors (217) 398-6300; (800) 682-8948; greatplanes.com.*

MonoKote; *distributed by Great Planes.*

SR Batteries Inc. *(631) 286-0079; srbatteries.com.*

W.S. Deans Co. *(714) 828-6494; wsdeans.com.*

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SIG MFG.

RASCAL

The Sig Rascal 110 has all the fine lines of a nostalgic '40s high-wing aircraft with the handling ease of a trainer. From the time you open the box until you set up the Rascal 110 at the field, your prevailing impression is "Wow! This plane is big."

by John Reid

110

PHOTOS BY JOHN REID

Classic, old-timer appeal in giant scale

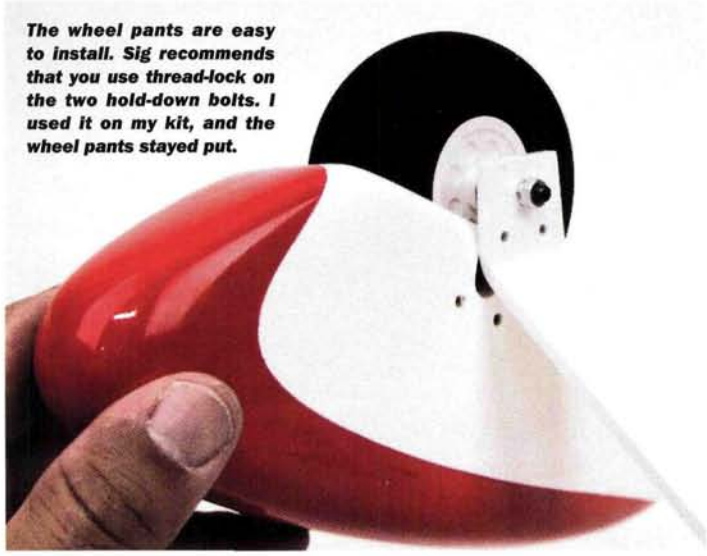
The Rascal 110 is the largest in Sig's line of Rascals, and it's available in blue or red trim. A plane of this size can accommodate a wide variety of engines from 1.20 2-strokes to 1.80 4-strokes to small gas engines. This wide range of potential powerplants allows the Rascal 110 to display a broad array of flying personalities. Depending on your engine choice, it can be a slow-flying trainer, a fun sport plane or a graceful, high-wing pattern flyer. With a few modifications, the Rascal 110 can also perform as a camera-platform, a parachute-dropping aircraft, or a glider towplane.

FIRST IMPRESSION

As you would expect from Sig, the kit exhibits top-quality materials and construction. In the box, the large red and white wings, stabilizer and rudder rest on a cardboard divider. Under the cardboard divider are the body, fiberglass cowl and wheel pants along with the stout aluminum landing gear. All of the main parts are wrapped in plastic bags for protection. For quick and easy assembly, Sig also includes a fuel tank, main wheels, a tailwheel, a spinner, engine mount, a decal sheet and a complete hardware package with high-quality stuff. Builders are guided through the construction with the aid of a 34-page, photo-illustrated instruction manual that includes installation steps for a gas engine and 2- or 4-stroke engine.

CONSTRUCTION

The first task with any ARF is to remove the wrinkles in its covering. The Rascal has just as many wrinkles as any other ARF, but it's so big that you have to set aside a little more time for this step. The Oracover covering is easy to work with, and with my iron set to 350 degrees, it took only a quick swipe followed by pressure from the hot glove to remove most of the wrinkles.



The wheel pants are easy to install. Sig recommends that you use thread-lock on the two hold-down bolts. I used it on my kit, and the wheel pants stayed put.

• **Wings.** The wings required only the installation of the hinges and the aileron servos. The four CA aileron hinges have a die-cut center slot that accepts a card wedge. When you insert the card wedge into the hinge gap, it can be accurately centered in the hinge slots. I centered the aileron in the wing panel's aileron bay and removed the card wedges one by one; then I added four drops of thin CA to each side of the hinges. With the ailerons glued into place, I installed the aileron servos.

I mounted the aileron servos on a plywood servo hatch that I attached with screws to the wing panel. After I had mounted everything, I added 24-inch servo extensions and secured the connectors at the ends of the extentions with heat-shrink tubing. A string is already routed through the wing to guide the servo wire through it. I connected the servos to the receiver and centered them. I made the pushrods and installed a control horn in each aileron. After I had hooked everything up, I secured the clevises with fuel tubing and checked to make sure that there wasn't any binding. Except for the decals, the wing was complete.

SPECIFICATIONS

MODEL: Rascal 110 ARF

MANUFACTURER: Sig Mfg.

TYPE: sport

WINGSPAN: 110 in.

WING AREA: 1,522 sq. in.

WEIGHT: 11 to 13 lb. (13 lb. test plane)

WING LOADING: 16.6 to 19.7 oz./sq. ft.

LENGTH: 75.75 in.

ENGINE REQ'D: 1.20 to 1.50 2-stroke, 1.20 to 1.80 4-stroke, 21 to 25cc gas

ENGINE USED: First Place 1.3 (gas)

RADIO REQ'D: 4-channel w/5 servos (elevator, rudder, throttle and ailerons [2])

RADIO USED: Airtronics RD 8000 transmitter, Airtronics receiver with three 94751Z digital servos, one 94162Z high-torque servo and one 94322 servo for throttle

PROP USED: Top Flite 16x8 Power Point

PRICE: $399.99

FEATURES: balsa and ply construction; fiberglass cowl and wheel pants; molded, clear-plastic windshield and side windows; aluminum landing gear; two-piece wing with aluminum wing joiner; scale-like tailwheel; pull/pull rudder; 450cc fuel tank; complete hardware package; spinner; engine mount; Oracover; decal sheet; 34-page, illustrated instruction manual.

COMMENTS: Sig Mfg.'s Rascal 110 flies gently and is easy to fly. Its size and classic lines give it a *wow* factor. This plane will always draw a crowd when you set it up at the field.

HITS

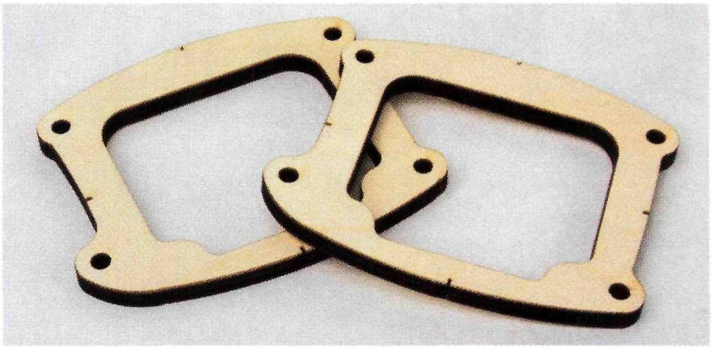
- High-quality construction.
- High-quality hardware.
- Great instruction manual.

MISSES

- None.

• **Engine.** I decided to install a gas engine to reduce my fuel costs and eliminate the need to do flight cleanup. Sig manufactures a great gas engine for the Rascal—the First Place 1.3 engine (FPE 1.3) with electronic ignition. The nice thing about using this engine is that the manual gives step-by-step instructions for its installation. Sig, always thinking ahead, also manufactures ¼-inch engine spacers for the FPE 1.3. These are real timesavers and are well worth the investment. They come laser-cut to match the back of the engine and have four centerline cuts that match the firewall centerline scribes. Lining an engine up with the centerline of the plane and cowl has never been easier. Be sure to order two packages (two spacers in each package) because you'll need 1 inch of spacing. I ordered only one set, so I had to make a ½–inch spacer.

I converted the glow-fuel tank to gas with Sullivan's conversion kit and then I installed it; I added Du-Bro's Kwik-Fill gas valve and routed the fuel lines. I drilled a hole in the lower right corner of the firewall to route the wiring from the ignition module to the engine; then I wrapped the ignition module in foam and placed it against the firewall inside the nose. I bolted on the engine, connected the throttle linkage and attached all the ignition-system wires. Before I could install it, I had to cut access holes for the carburetor in the fiberglass cowl so it would fit around the engine. Then I moved on to installing the tail feathers.



These engine-mount spacers are a great investment if you plan to use Sig's First Place 1.3 engine. They make aligning and mounting the engine under the cowl a snap.

• **Tail feathers.** Installing the Rascal's tail feathers was perhaps easier than on any other plane that I have built so far. My only problem arose when I had to install the wings to square up the elevator; the plane is so big that I had to take it outside. Then, everything went together so well that for the first time, I used 5-minute epoxy instead of 30-minute to assemble the tail group. I finished the tail feathers by installing the control horns and gluing in the hinges.

• **Radio installation.** The servo cutouts had already been made, so it was just a matter of installing the servos in the proper spots. This was the first time I had installed a pull/pull connection to the rudder, and I was apprehensive about doing it. The instructions do, however, explain the procedure very well, and I didn't have any problems installing everything. I then wrapped the receiver in foam, hooked everything up and installed the receiver on the tray in the fuselage using rubber bands. That pretty much wrapped up the radio installation, except for battery placement, which I determined later when I balanced the plane.

The Rascal looks and flies great and offers top-quality construction.

• **Wheels.** Installing the wheels, wheel pants and landing gear to the fuselage is simple and straightforward. To prevent

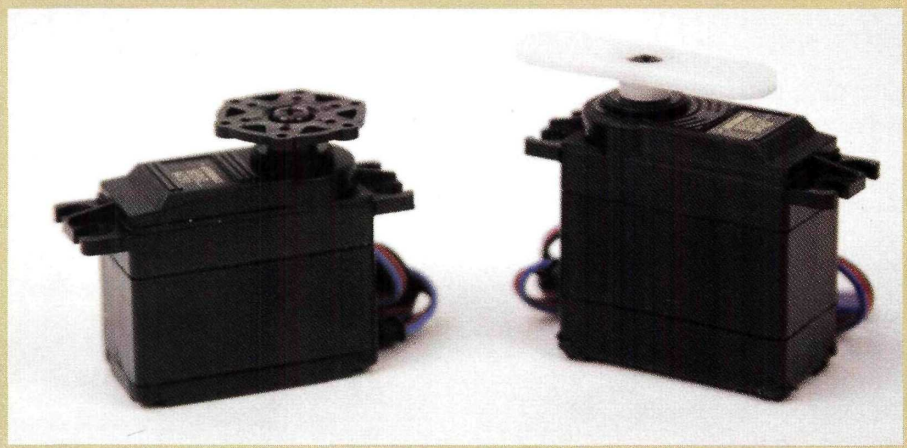
POWER TO THE CONTROL SURFACES

Large planes like the Rascal have big control surfaces that need a fair amount of servo torque just to move them, even on the ground. When the plane is airborne, pressure on the control surfaces increases their resistance to being moved (this is particularly true of fast planes such as pylon racers). It also increases the stress to the control linkages and servos. You can use standard servos in a large plane like the Rascal, but they will always have to work at their maximum torque to move the control surfaces. This could cause servo failure and lead to your airplane crashing—a slight possibility, but keep it in mind. Stronger servos are more appropriate for a model of this size. For this reason, I used Airtronics' Digital Competition servo (item no. 94751Z) and high-torque metal-gear BB servo (94162Z).

The 94751Z Competition Digital servo is great for the ailerons and elevator because digitally enhanced microprocessors reduce response time (compared with non-digital servos). I really notice this speed when the servos center the control surfaces; they center up extremely quickly and precisely. The 73 oz.-in. of torque is just what I need, and if I want to, I can increase it to 91 oz.-in. by using a 6V battery.

I used the new Airtronics high-torque servo on the rudder because I had installed a pull/pull system, and I wanted the higher torque for this control system. Digital servos on the rudder of a tail dragger will sometimes cause the plane to wobble back and forth while it's just sitting on the ground. If the plane isn't moving and gets bumped, the servo will over-correct for the movement on the rudder, bring the control surface too far back and overcorrect again. This will continue until the tail is lifted off the ground or the plane taxis forward a little. Of course, this only happens when the plane is stationary—never in the air or while it taxis. The 94162Z is a high-torque, metal-gear ball-bearing servo that can produce 123 oz.-in. on 4.8 volts, but if you use a 6V battery, it will produce 154 oz.-in. of torque. That's 9.63 pounds! That will ensure that I'll have more than enough torque to move that rudder under any circumstances.

With these servos in the Rascal, I can fly comfortably knowing that I have more than enough control authority for any maneuver that I might want to try with this big plane.



Left: the Airtronics Competition Digital servo (94751Z); its high torque and quick, precise response make it a perfect servo for the Rascal's elevator and ailerons. Right: the new high-torque, metal-geared servo (94162Z) that produces 123 oz.-in. on 4.8 volts—perfect for the rudder's pull/pull system.

FLIGHT PERFORMANCE

With the plane balanced and the controls set at the manufacturer's recommendations, I packed up the Rascal 110 and headed to the field. At the field, I joined the wing halves and attached the functional wing struts. This went quite fast, and the wing struts really add strength and rigidity to the wings; never fly without them. That the wing is in two pieces makes transporting the Rascal much easier. I did two range checks with the engine off and with it running. The First Place 1.3 engine was easy to adjust and appeared to have more than enough power for the Rascal. The plane was easy to taxi out to the runway; I pointed its nose into the wind and throttled up.

TAKEOFF AND LANDING

The Rascal's tail came off the ground just after I had throttled up, so I had to jump on the elevator rather quickly—not really a big problem, but it did surprise me. Rudder control on the ground was good, and once the tail came up, its control was responsive and solid. The Rascal tracked extremely well down the runway, and after a brief, straight run, I added a little up-elevator. The plane gracefully took to the air in a smooth and gradual climb-out. I had to add a little down-trim and right aileron trim to achieve level, hands-off flight. After that, the Rascal's flight was very predictable, and it flew just as I wanted it to. It tracked straight and true in any direction I pointed it. There wasn't any need for rudder-assist in the turns; I just used ailerons and elevator to execute most of them.

Its first landing was beautiful: it slowly settled onto the runway, and the main gear touched down softly and was quickly followed by the tailwheel. You will be impressed with its glide rate; it just wants to keep flying. On my second landing, I switched to high rates on the transmitter, and the landing was a little jerky (nowhere near as smooth as the first) because I had very responsive control from the elevator even at slow speeds. Needless to say, I always land with low rates now and let the Rascal settle in slowly; by doing that, I look like a pro.

LOW-SPEED PERFORMANCE

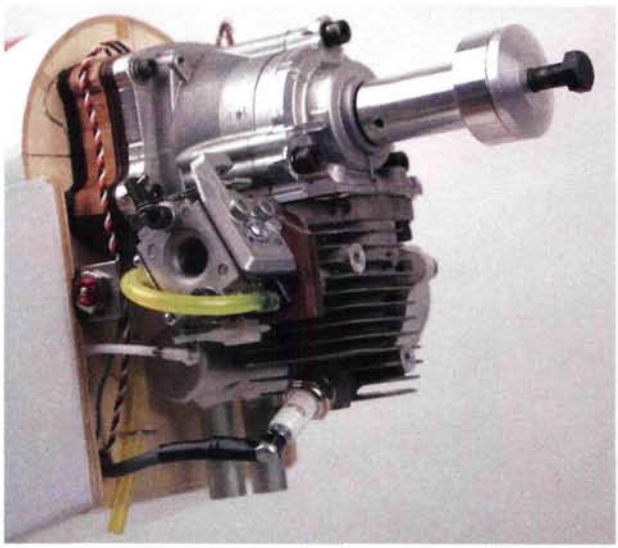
The Rascal didn't show any tendency to drop a wing at slow speed; in fact, all of the controls were very responsive throughout the flight, including the entire landing pattern—all the way down to the ground.

HIGH-SPEED PERFORMANCE

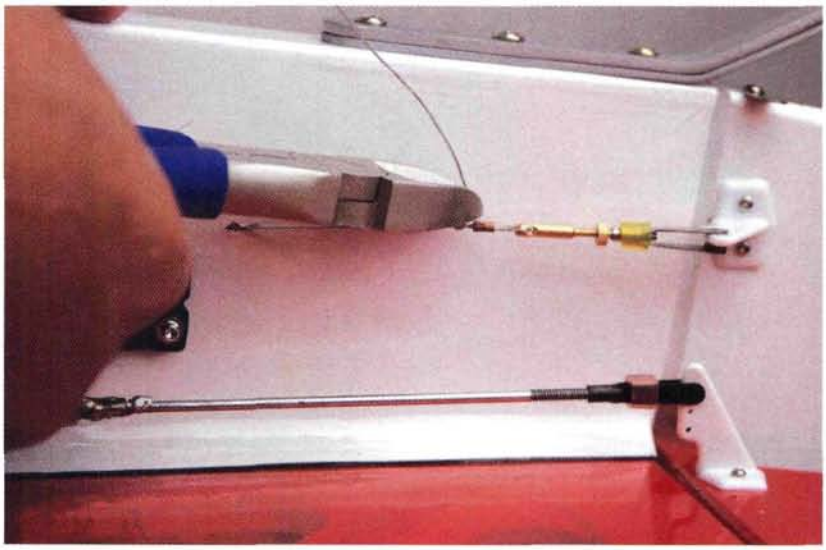
I expected the Rascal to be a good flyer at full throttle, and I wasn't disappointed. At high speeds, it handled extremely well and displayed smooth, responsive controls. With the recommended control throws, it responds immediately to my inputs and with just the right amount of speed. I never felt as if I had too much throw or that the plane was overly sensitive.

AEROBATICS

The Rascal 110 was not designed to be IMAC-capable, but it can perform a wide array of maneuvers. Rolls are slow and require assistance from the rudder, but with some practice on your part, they can be very axial and smooth. Loops are about as graceful as those of any plane I've ever seen, and the Rascal tracks through with little need for rudder correction. Inverted flight required a little down-elevator (which plane doesn't?), and this high-wing plane looks somewhat odd in that position. Snap rolls are awesome when you enter them at about ¼ throttle (as Sig recommends). The rudder is very effective, and you will find that all the maneuvers that require rudder movement are a blast to perform. You have to see knife-edge flight! I don't think I'll ever get tired of flying this large, graceful plane.



The engine is installed and ready for the cowl. All of my ignition wires come out at the bottom left corner of the firewall. The gas fueling valve bracket is included in the kit.



The rudder's pull/pull system; after removing the slack from the line, I clamped the wires by crimping the small brass swage tube with needle-nose pliers. Then I clipped off the loose ends of the wires.

any bolts from loosening later on, I used medium thread-lock on all of them.

• **Final details.** The Rascal comes with a sheet of decals that I applied by using soapy water on the plane, so I could move them around for final placement. I checked all of the control surfaces for the proper amount of throw, and I balanced the plane with the help of my son (each of us at a wingtip lifting the plane with one finger on the spar). That's all; the Rascal was ready for the flying field, and I put the battery on the charger to prepare it for its first flight.

CONCLUSION

The Rascal looks and flies great and offers top-quality construction. If you are looking for a plane that has good flying characteristics and will draw a crowd whenever you take it out of your car (you'll need a big trunk for this one), the Sig Rascal is the one for you.

Airtronics (714) 978-1895; airtronics.net.
Du-Bro Products (800) 848-9411; dubro.com.
PowerMaster Hobby Products Inc. (512) 285-9595; powermasterfuels.com.
Sig Mfg. Co. Inc. (800) 247-5008; (641) 623-5154; sigmfg.com.
Sullivan Products (410) 732-3500; sullivanproducts.com.
Top Flite; distributed by Great Planes Model Distributors (217) 398-6300; (800) 682-8948; top-flite.com.


LASER 200

LANIER RC Laser 200 ARF

by Jim Onorato

1/3-scale showstopping aerobat

Originally built and flown by seven-time U.S. National Aerobatic champion Leo Loudenslager, the full-scale Laser 200 dazzled airshow fans for years with its amazing aerobatic capabilities. And in the years since the full-size version began to wow audiences, several radio-control manufacturers have produced models of this outstanding performer in various sizes. Lanier RC has produced kits of the Laser 200 in 1/4 and 1/3 scales, and the addition of this 1/3-scale, almost-ready-to-fly (ARF) version to Lanier's popular line is sure to delight Laser fans the world over.

The Laser speaks for itself. What a beautiful plane!

SPECIFICATIONS

MODEL: Laser 200 ARF

MANUFACTURER: Lanier RC Inc.

TYPE: 1/3-scale unlimited aerobat

WINGSPAN: 96 in.

WING AREA: 1,596 sq. in.

AIRFOIL: symmetrical

WEIGHT: 22 lb., 6 oz.

WING LOADING: 32.3 oz./sq. ft.

LENGTH: 79 in.

RADIO REQ'D: 4-channel w/7 servos (throttle, 2 elevator, 2 rudder, 2 aileron)

RADIO USED: JR XP8103 8-channel w/8 JR servos and remote kill switch (servos: no. 8411 for ailerons [2], no. 8101 for rudder and elevator [4], no. 537 for the throttle and kill switch [2])

ENGINE REQ'D: 3.2 to 4.2 2-stroke, 2.4 to 3.0 4-stroke

ENGINE USED: Fox 4.2 2-stroke gas

PROP USED: 23x10 Mejzlik

PRICE: $599.99

FEATURES: comes 90-percent built and expertly covered; features plug-in, built-up wings and built-up tail feathers; fiberglass cowl and wheel pants painted to match the Stars 'n' Bars trim scheme on Insignia Blue covering; fuselage constructed of lite-ply with a balsa-sheeted turtle deck and a forward hatch/canopy; comes with high-quality hardware including landing gear, wheels, a tailwheel, Robart hinges, a fuel tank, tailwire braces and heavy-duty control horns and pushrods.

COMMENTS: the Laser 200 is a proven aerobatic performer and a blast to fly. Lanier RC makes it easy to get into the air quickly with a high-quality, well-made airplane that will certainly turn heads at the flying field.

HITS

- Excellent flight performance and low-speed stability.
- High-quality hardware included.
- Expertly constructed and finished.

MISSES

- None.

WHAT'S IN THE BOX?

This new, 94-inch-wingspan Laser 200 is an ARF version of the company's earlier 1/3-scale kit. This built-up, all-wood kit features a painted fiberglass cowl and wheel pants, and the fuselage is constructed of lite-ply and balsa; there's also a balsa-sheeted turtle deck and forward hatch/canopy. The tail feathers are light balsa frames, and the plug-in wing panels are built up with lite-ply and balsa sheeting. The model is expertly covered with Insignia Blue film with white stars and yellow "bars" (similar to the trim scheme used by Jim Roberts on his full-size Laser). All of the control surfaces are dual-beveled at the hinge line to allow maximum deflection for all those radical maneuvers.

I was particularly impressed by the quality and completeness of the hardware, most of which is from Sullivan Products and includes 4-40 pushrods and clevises, heavy-duty bolt-type control horns for the ailerons and heavy-duty nylon horns for the tail feathers. It even includes a Sullivan fuel tank, Sullivan Skylite wheels and all the parts required for the tail-wire braces. There are Robart hinge points for all of the control surfaces. The 16-page instruction manual gives step-by-step instructions, and there are plenty of photos to guide you through the assembly. This is a very complete kit. It looked great in the box and even better when assembled.

ASSEMBLY

• **Wings.** Assembly begins with the wing panels. All you have to do here is attach the ailerons and install the aileron servos (one in each panel), the control horns and the linkages. The ailerons and wing panels are drilled to accept the Robart hinge points (five in each aileron) provided in the kit.

To ensure the proper alignment of the hinges, I first applied petroleum jelly to the pivot points and then put 30-minute epoxy into the holes drilled in the wing and the aileron, and I put a little on both tips of the hinge points. I then inserted the hinge points into the wing and aileron and flexed the aileron up and down while sliding it onto the wing. This caused the hinge points to rotate into perfect alignment. Once the epoxy had cured, I installed the control horns and two JR 8411 digital servos and hooked them up using the linkages provided.

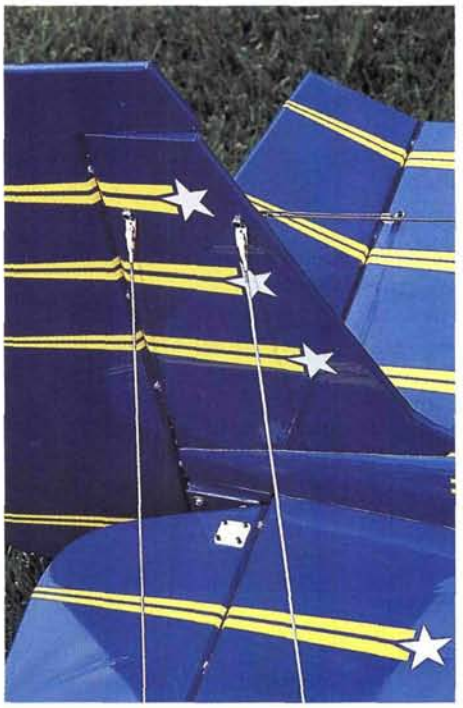
> The Laser is ... capable of every imaginable maneuver ...

I particularly like that a phenolic tube is permanently installed in the fuselage to accept the aluminum wing spar that's used to hold the plug-in wing panels. This eliminates the possibility of the aluminum wing spar's wearing away the holes in the fuselage sides and allowing the wing panels to loosen. Both wing panels contain two anti-rotation dowels. I made sure that they were securely glued into place, and then I trial-fit the panels on the aluminum spar. The holes for the pins, which set the proper wing incidence, are already drilled in the fuselage. If the pins do not let the wing seat properly, remove a little wood from the front or back edge of the hole in the fuselage. (Do this only if absolutely necessary, and do not remove wood from the top or bottom edge, as that would affect the wing incidence.) I fastened the panels to the spar with 6-32

capscrews threaded through hard points in the top of the wing.

• **Tail and control surfaces.** After removing the covering from the areas to be glued, I installed the stabilizer and fin, being careful to keep the stabilizer parallel to the wing. When the 30-minute epoxy I used had fully cured, I attached the elevators and rudder using the provided Robart hinge points, and I installed them using the same procedure as I used for the ailerons.

The elevators require two servos, and Lanier recommends that you also install two servos for the rudder; the two rudder pushrods act in a pull/pull setup for maximum force. All four servos should be installed at the rear of the fuselage. I used a standard Y-connector for the rudder and a reversing Y-connector for the elevators. Of course, if you have a computer radio, you could connect the elevator servos to two different channels and eliminate the reversing Y-connector. I used four JR 8101 servos for the elevators and rudder, and I connected them using the included hardware. When all the controls had been hooked up, I installed the tailwheel assembly and the tail-wire braces.

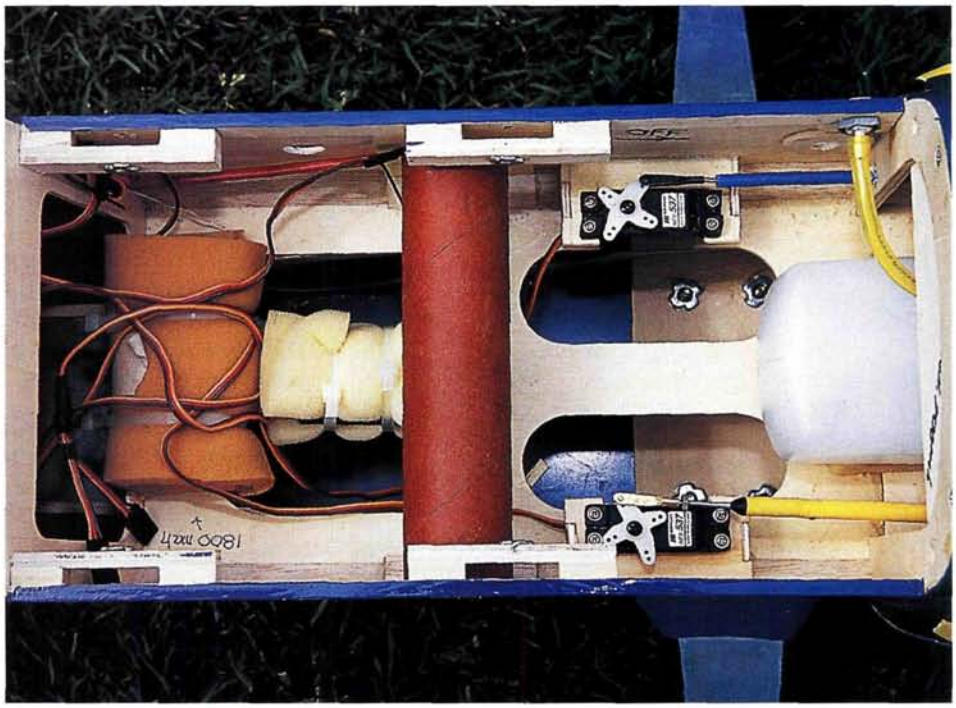


After hooking up all of the controls, I installed the tail-wheel assembly and the tail-wire braces.

• **Engine installation.** I measured the lengths of the cowl and engine to determine where the firewall should go, and then I glued it into place with 30-minute epoxy. I pinned both sides in three places with 1/16-inch dowels, and I reinforced the firewall joints with 1/2-inch triangle stock.

Lanier recommends a 3.2 to 4.2 2-cycle engine for the Laser. I chose a Fox 4.2 gas engine with a giant-scale Slimline muffler. I mounted the engine using four, 10-32 socket-head bolts and blind nuts, and to give the engine right thrust, I put two no. 8 washers on the mounting bolts between the firewall and the engine mount on the engine's left side. I mounted the ignition module, with battery, on top of the engine box behind the firewall, and then I installed a servo-operated kill switch in the engine box behind the firewall and a manual kill switch in the cowl.

• **Final assembly.** Next came the assembly and installation of the landing gear, the wheels and the wheel pants—all of which are of excellent quality. The landing gear is of heavy-duty, 3/16-inch formed aluminum and has steel axles. The wheels are 4-inch Sullivan Skylites, and the wheel pants are painted fiberglass. I attached the landing gear to the fuselage with 4mm bolts and blind nuts.



Because the elevator and rudder servos are all in the rear of the fuselage, the radio box actually holds very little equipment. The servos shown here are for the throttle and kill switch.

The Laser comes with a 24-ounce Sullivan fuel tank that has a stopper and a pick-up line that's suitable for gasoline. If you plan to use a glow engine, replace the stopper and line with ones made out of silicone. I assembled the tank and secured it in the fuselage with the included cable ties. I decided to add a third fuel line for filling, and I attached this to a Slimline fueler fitting, which I installed in the side of the fuselage just behind the firewall.

The cowl features a 7/16-inch-thick plywood split ring and is attached to the fuselage with four bolts. The two rear bolts are accessible from the canopy area, and the two front bolts are accessible through the cowl. The latter two require the use of a very long Phillips-head screwdriver to install. I used a Dremel tool to cut an opening in the bottom of the cowl for the engine head and the muffler and made it large enough to allow proper cooling.

The removable canopy frame extends to the cowl and allows easy access to the interior of the fuselage. Before I attached the clear canopy, I painted the inside of the cockpit with flat-black acrylic paint and installed a 1/3-scale Hangar 9 civilian pilot figure and instrument panel.

Last, I installed the throttle servo and the kill-switch servo in the fuselage behind the motor box. I used an 1800mAh receiver battery and placed it at the rear of the canopy area to achieve the proper balance. The addition of a 23x10 Mejzlik prop and a beautiful 4-inch Tru-Turn aluminum spinner completed the assembly.

CONCLUSION

If you have quite a bit of flying time under your belt and are looking for a big aerobat that doesn't take forever to build, the Lanier RC Laser 200 ARF might be just the plane for you. It goes together easily,

FLIGHT PERFORMANCE

FLIGHT PERFORMANCE

At low rate, the instructions recommend rather modest control throws (1½ inch for rudder; 1 inch for elevator; ½ inch for ailerons). At high rate, they suggest that you get all you can out of the control throws—a must for slow-speed 3D aerobatic maneuvers. If, however, you do not intend to perform 3D-type maneuvers, I suggest that you initially set the high-rate throws to no more than double the low-rate throws. For my initial flights, I played it conservatively and set up my transmitter to give the recommended low-rate throws on all control surfaces.

After range-checking my radio, I topped off the tank and fired up the Fox for the Laser's first flight.

TAKEOFF AND LANDING

The Laser feels firm on the ground and taxies nicely without any tendency to nose over. On the first flight, I pointed it into the wind and slowly advanced the throttle while holding in a bit of up-elevator to keep the tail down. The Laser tracked straight ahead without any right rudder. I relaxed the up-elevator, and when the tail came up, I let it roll about 100 feet before applying just a touch of up-elevator. The Laser lifted smoothly into the air with its wings perfectly level.

Landings are quite gentle. The Laser has a shallow glide slope that allows it to descend very slowly. I maintain power until it is about 1 foot off the runway, and then I apply just enough up-elevator to give the plane a gentle flare. The result is usually a very smooth three-point landing. After the first flight, I realized that the Laser did not require any trim adjustments.

LOW-SPEED PERFORMANCE

The Laser is smooth and predictable at slow speed. It has a low stall speed, and its stalls are quite gentle. It can be flown very slowly without losing stability, and it can execute all except vertical maneuvers at part throttle. The Laser is very forgiving and can be flown safely at slow speeds.

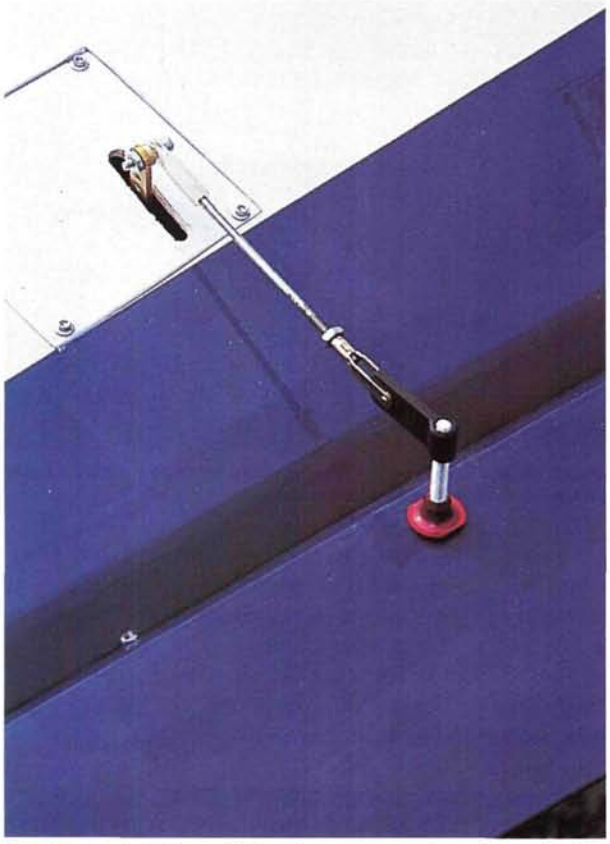
HIGH-SPEED PERFORMANCE

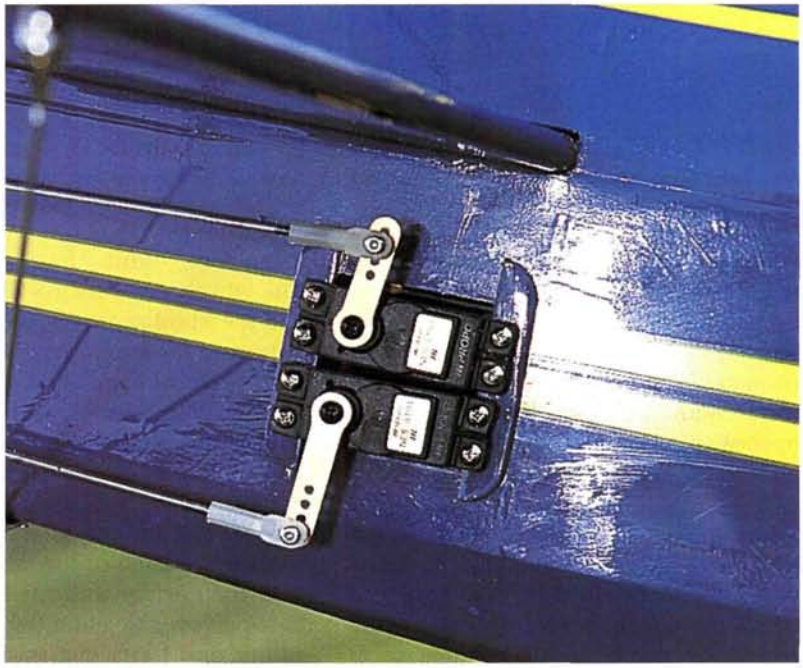
At high speed, the Laser is a "go where you point it" airplane. It tracks extremely well and is a smooth, stable flyer. Using the recommended low-rate throws on all control surfaces, I did not encounter any bad tendencies at high speed. The recommended elevator throw is 1 inch at low rate. More than that is likely to result in a high-speed tip-stall that will cause the plane to roll out at the top of a loop or snap at the bottom.

AEROBATICS

The Laser is a proven aerobatic airplane that's capable of every imaginable maneuver. I expected it to perform well and was not disappointed. Inside and outside snap rolls are things of beauty—just fast enough to be appreciated. Axial rolls are fast and truly axial. Sustained knife-edge and outside, 360-degree turns aren't a problem, and spin recovery is within ¼ spin when the controls are released. The plane requires only a little down-elevator to maintain level inverted flight. Its aerobatic performance should satisfy even the most accomplished pilots. It certainly satisfied yours truly! Though I have not attempted any 3D maneuvers, I have no doubt that in the hands of a more capable pilot, the Laser would be able to do them.

The Fox 4.2 was not powerful enough to give unlimited vertical performance, but it provided sufficient power to haul the Laser straight up as far as I needed to go. Overall, I was very pleased with the performance of both the plane and the engine.





Top: the installation of the aileron servos (one in each wing panel), control horns and linkages is about as simple as it gets. Right: the elevators require two servos, but the folks at Lanier recommend that you also install two servos for the rudder; all four are toward the rear of the fuselage.

is very aerobatic and has good low-speed stability. Best of all, it looks great both on the ground and in the air. I really enjoyed building and flying this airplane. ✈

Dremel *(800) 437-3635; dremel.com.*
Fox Manufacturing *(479) 646-1656; foxmanufacturing.com.*
Hangar 9; *distributed by Horizon Hobby Inc.*
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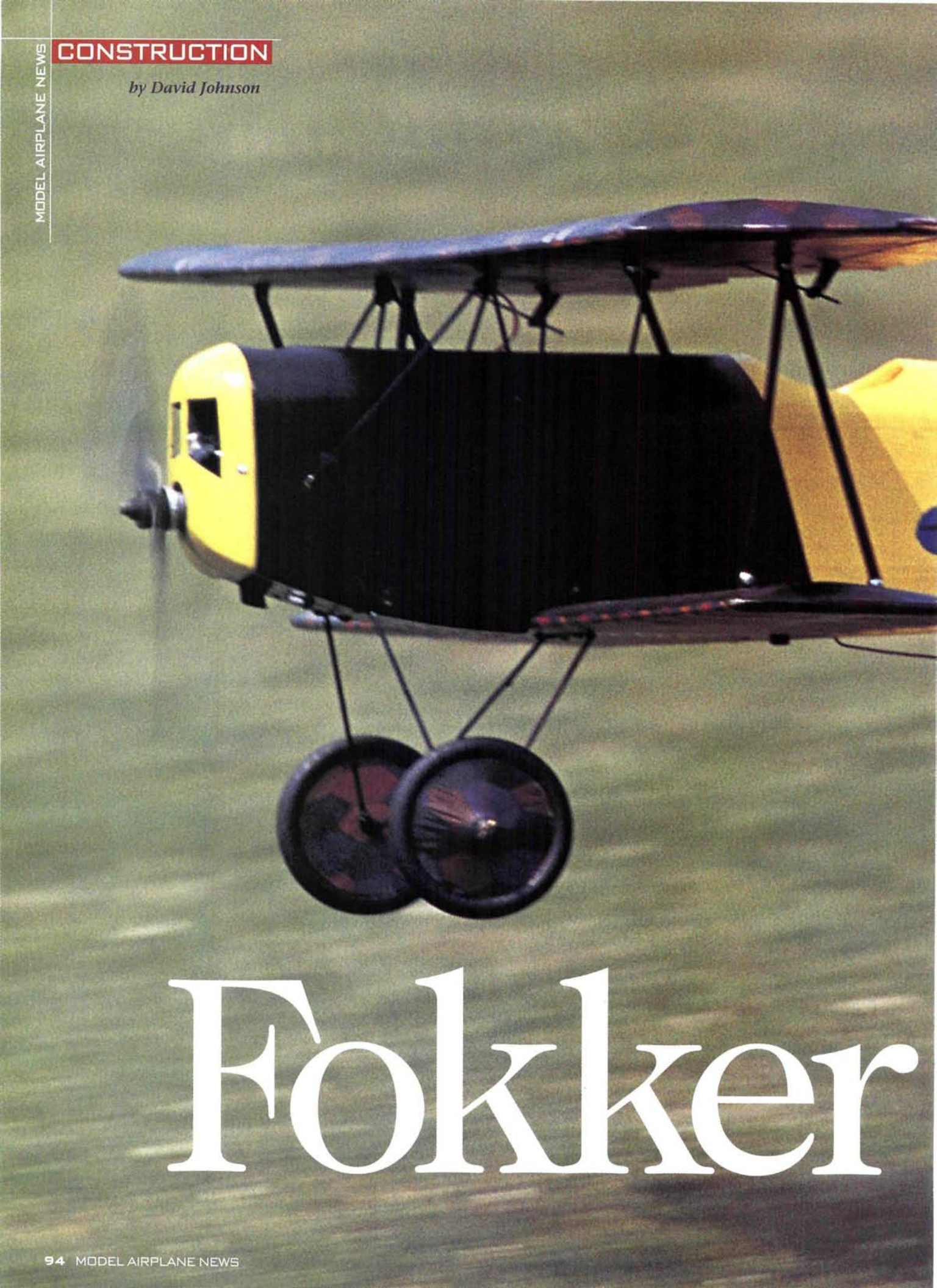
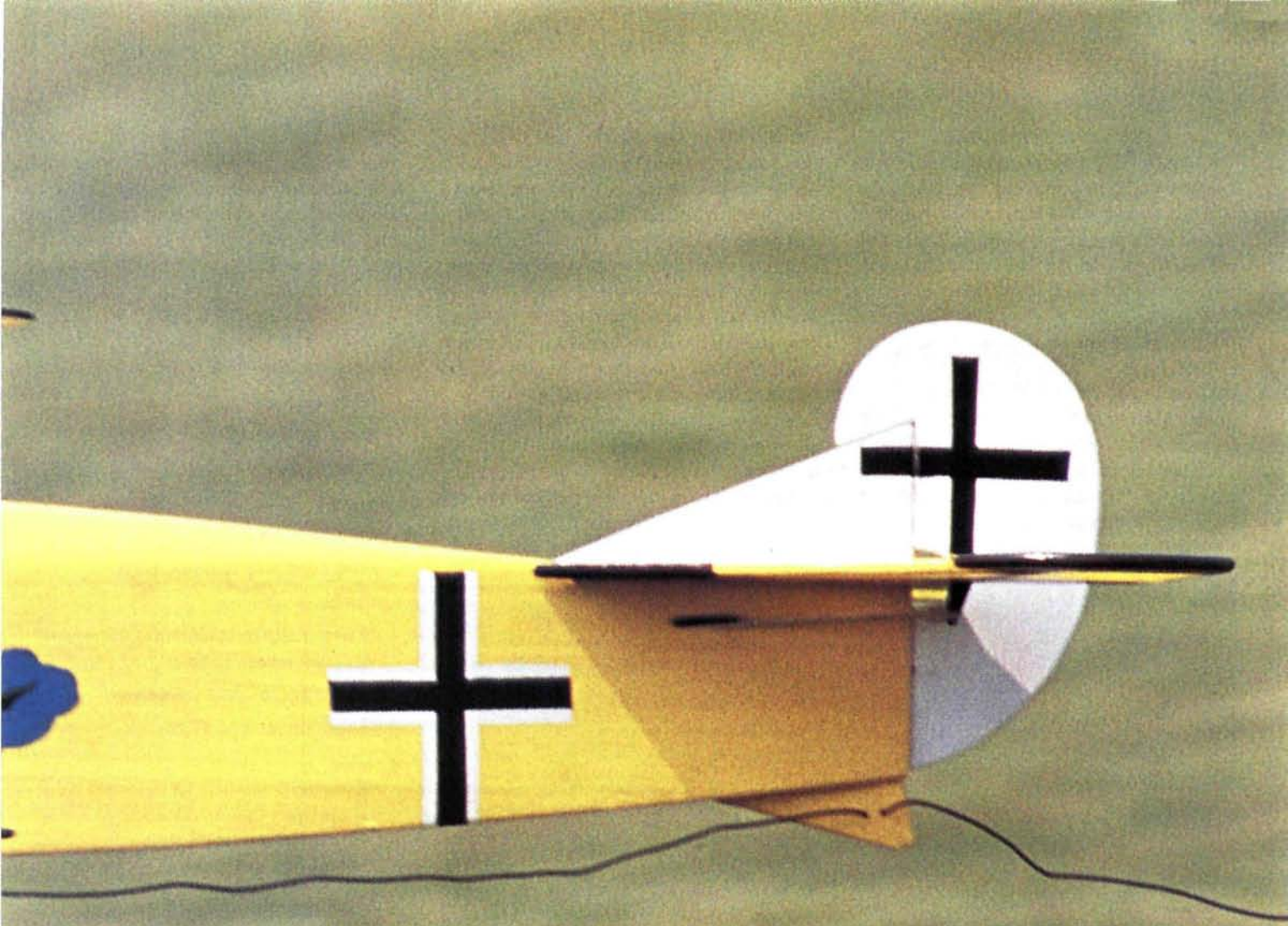
CONSTRUCTION

by David Johnson



Fokker



A mini WW I fighter for RC combat

D-VII

PHOTOS BY DAVID JOHNSON

Your adrenaline pumps as you plan your attack. You dive onto your opponent and go for the kill. But before you can finish your thought, your adversary reacts and is now gunning for you! Have you ever wanted to fly combat, but the thought of the 1/12-scale WW II high-velocity planes put you off? If so, this Fokker D-VII may be for you.

CONSTRUCTION NOTES

The Fokker D-VII is relatively simple and quick to build. I recommend that you begin by cutting a kit of parts, as this constitutes the lion's share of work in building the model. Once this has been accomplished, start with the fuselage construction.

• **Fuselage.** Begin by making the left and right sides from 3/32-inch balsa. The fuselage side measures 4 5/16 inches at its widest point. You can either join two sheets of balsa together or purchase sheets that are 6 inches wide; the choice is yours. Next, glue in the 3/32-inch fuselage doublers, and lay out the locations of the formers and the strut blocks on the fuselage sides. To avoid making two of the same sides, lay them back to back in a mirror image. To preserve the model's looks and avoid interfering with the cabane struts, I used a C.B. Tatone Universal .29 to .45 in-cowl muffler. If you don't want to go this route, rotate the engine mount 90 degrees so the muffler faces the bottom of the fuselage. The only downside to this is that the engine's head will protrude out of the fuselage side. Another reason I chose a C.B. Tatone muffler was that it would allow me to direct the exhaust straight out the bottom of the plane.

Epoxy the 1/8-inch lite-ply firewall F-2 and the 1/4-inch lite-ply engine mount F-2A into place on one of the sides, making sure that they're 90 degrees to the side. After the glue has set, glue the other fuselage side on the formers (the sides must be square to each other), and let the glue cure. Now place the fuselage over the plan, and pull the rear of the fuselage

SPECIFICATIONS

MODEL: Fokker D-VII

TYPE: sport-scale WW I biplane

WINGSPAN: 43.25 in.

LENGTH: 32.5 in.

WEIGHT: 55 oz.

WING AREA: 519 sq. in.

WING LOADING: 15.26 oz./sq. ft.

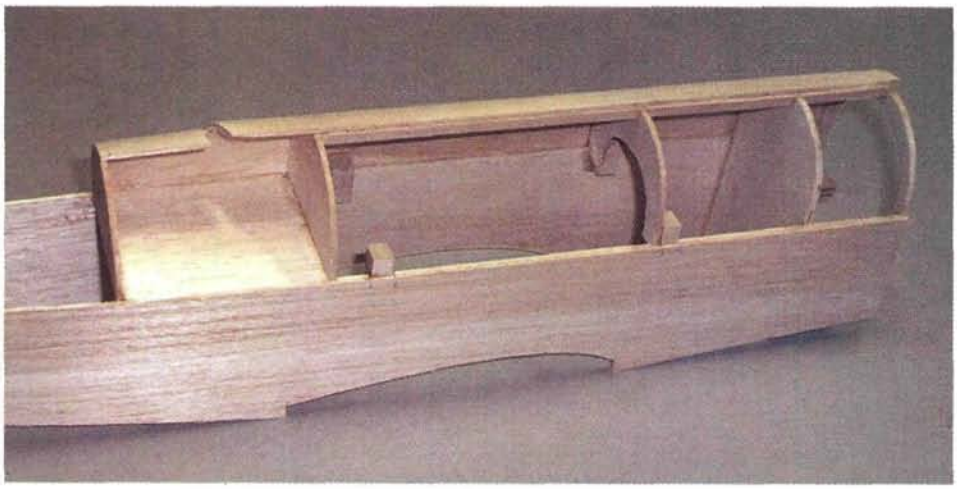
AIRFOIL: flat-bottom

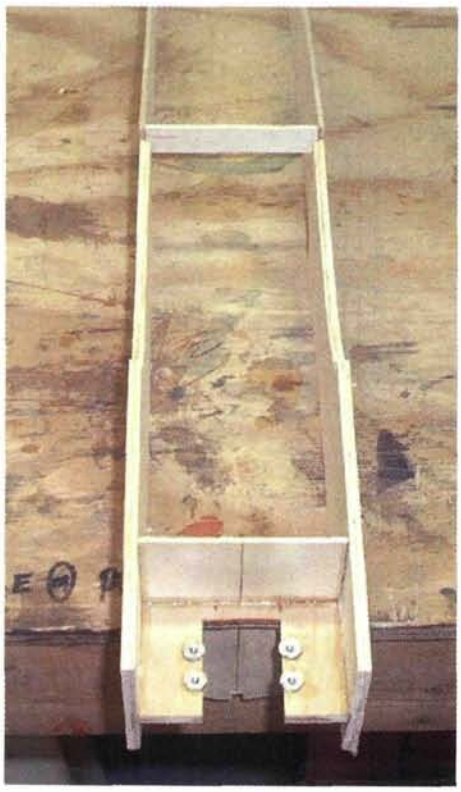
RADIO REQ'D: 4-channel (aileron, elevator, rudder, throttle)

ENGINE REQ'D: .25 2-stroke

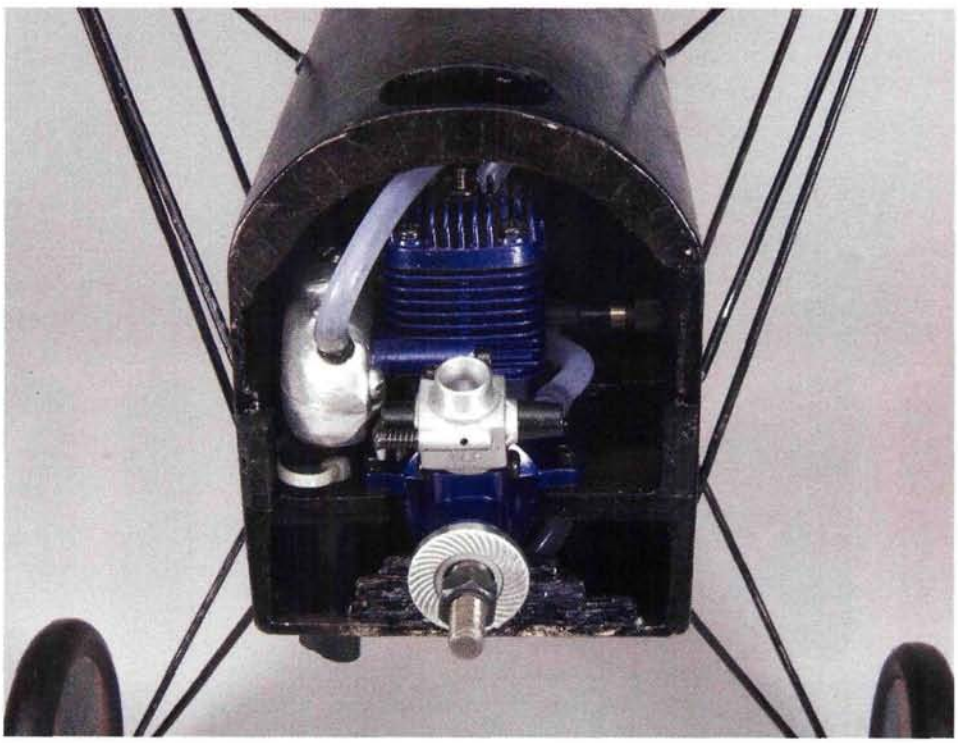
ENGINE USED: O.S. .25 LA

COMMENTS: this diminutive Fokker D-VII is extremely easy to build and uses traditional construction techniques. The model has been designed around a .25-size engine and a C.B. Tatone Universal muffler for building ease. Flight performance is very good, and it doesn't have any of the bad habits that small biplanes sometimes exhibit.





Top: the fuselage is 3/32-inch sheet balsa with formers to give it its shape. Here, the foredeck is being sheeted. Below left: the engine mount is made of 1/4-inch lite-ply and glued to the firewall and fuselage sides.

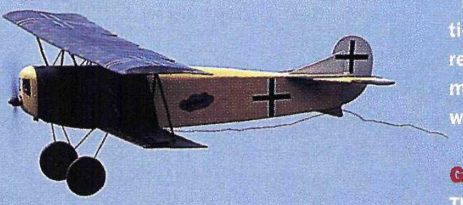


The O.S. .25 LA and C.B. Tatone in-cowl muffler fit nicely in the Fokker's nose. Cooling the engine hasn't been a problem.

FLIGHT PERFORMANCE

In my model, I used an O.S. .25 LA; it provides just the right amount of power for aggressive dogfights without overpowering it.

Set up the control throws with ½ inch of up- and down-travel on the elevator and as much aileron and rudder travel as you can get without binding the linkages or servos.



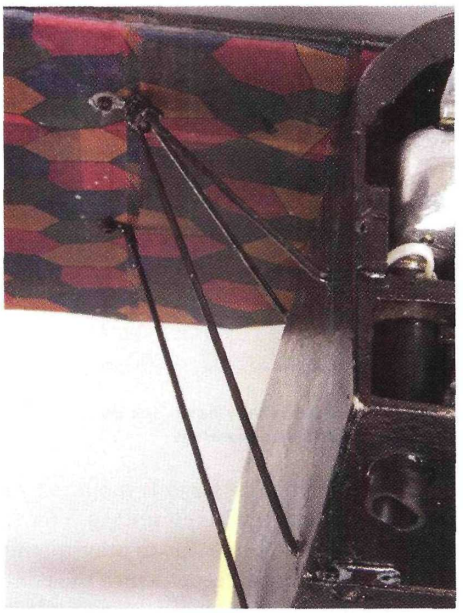
TAKEOFF AND LANDING

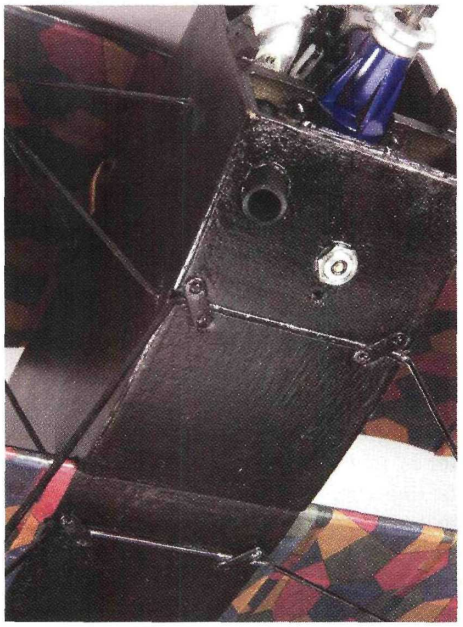
Despite the lack of a steerable tailwheel, the little Fokker taxis well. When you turn the model on the ground, blip the throttle as you use a touch of down-elevator; the tail will swing right around. Slowly apply full throttle as you head into the wind, and steer with rudder to keep the model on track. The plane will take off in about 20 to 30 feet at about a 10-degree angle of attack.

The D-VII has very gentle landing characteristics. Make sure that your engine has a low, reliable idle, or it can be difficult to get the model to slow down enough and land; it just wants to keep flying!

GENERAL FLYING CHARACTERISTICS

The plane has no bad habits. At full throttle, the plane will fly at around 50mph, and it's rock solid. Its slow-speed performance is just awesome; you can fly figure-8s right on the deck at a walking speed without its stalling out. The D-VII will perform all WW I maneuvers, such as loops, rolls, chandelles, spins, Immelmanns and wingovers with ease. Everyone who has flown the D-VII has been highly impressed with it. In fact, several of my club members have built one. I hope you'll enjoy yours as much as I enjoy mine!





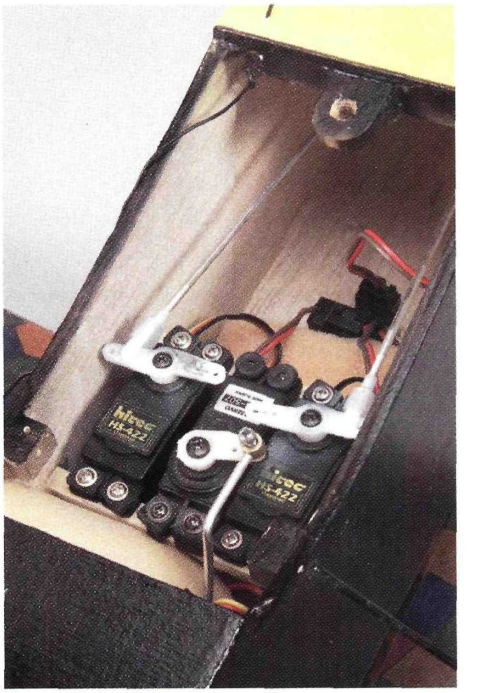
Above: the cabane struts are 3/32-inch music wire, and they plug into the fuselage and screw into the top wing. Below: I use a three-line fuel system and installed a fuel fitting in an inconspicuous spot on the underside of the nose.

together; install formers F-5, F-6A and F-9. Clamp, make sure that the fuselage isn't bowed, and glue everything together. Install the rest of the formers, and sheet the fuselage bottom with 1/16-inch balsa placed cross-grain. Add the 3/16-inch square stringer to the top formers.

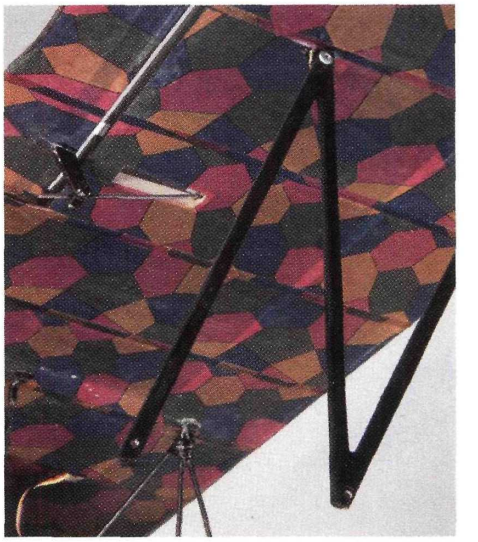
Now comes the only tricky part of building the D-VII: sheeting the top of the fuselage. First, bevel the top of the fuselage sides to match the formers all the way to the stabilizer. This will ease the task considerably. Lightly wet the top side of the 3/32-inch balsa, and starting at the center of the stringer, sheet from the rear of the cockpit forward. Sheet the other side and let dry. Trim the wood, and repeat the process for the rear of the fuselage; then cut out the cockpit opening. The nose of the fuselage is a block of soft balsa that's carved to shape and then hollowed out. There's nothing complicated about it. Next, the wings!

Simple to build and fun to fly; what more could you ask for in a WW I model?

• **Wings and tail feathers.** The wings are pretty self-explanatory and, again, build quickly. Resist the urge to beef them up! There isn't any dihedral, and none is required. If you splice the leading edge and spars together, make sure that the splices are outboard on the panels, and also stagger them. A good splice joint with a little epoxy will produce a strong joint. I



Above: the servos are installed as far forward as possible. The receiver and battery are in front of the servo tray. Below: this view shows the N-strut attachment to the top wing. A single servo in the center of the wing is used for both ailerons.



WW I Combat Guidelines

I have been flying WW I planes for a number of years and have had a few impromptu dogfights with some of my flying buddies with our ¼-scale models. With the time and expense involved with a model of that size, you don't want to get extremely aggressive, as the consequences of a midair would be dire. Yet, the experience could not be replicated for me with the high-speed WW II-type models currently being used for combat. The following is a loose and modifiable guideline of rules for WW I combat.

PLANE SPECIFICATIONS

MINIMUM SIZE (WINGSPAN):
Monoplanes–48 in.
Biplanes–42 in.
Triplanes–36 in.

MINIMUM AIRFOIL THICKNESS: 9/16 in.

MAXIMUM WEIGHT: 4 lb.

ALLOWABLE ENGINES: plain-bearing .25 2-strokes

These rules as outlined are designed to encourage engagement while maintaining a bit of good judgment. The bottom line is to have fun while being competitive. Give WW I combat a try; it's a real hoot!

RULES OF ENGAGEMENT

Scale 3-view to be provided at CD's request.
Aircraft must be able to ROG.
No profile models allowed.
Tow string to extend 10 feet behind the aircraft's tail.
Streamer to be 25 feet long.

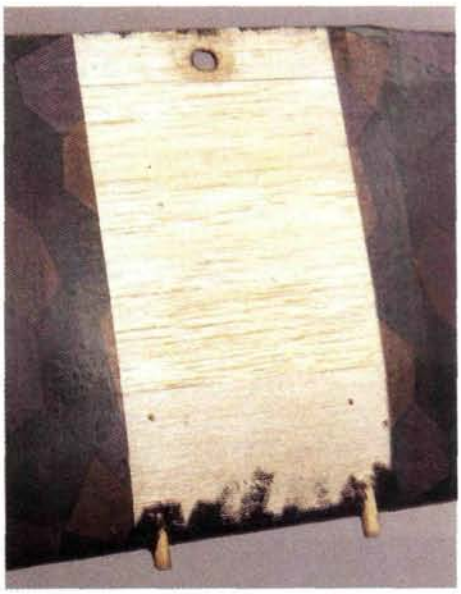
ON-TIME TAKEOFF: 10 points (engine start within 2 minutes).

FLY FULL ROUND: 10 points (a round is 5 minutes long).

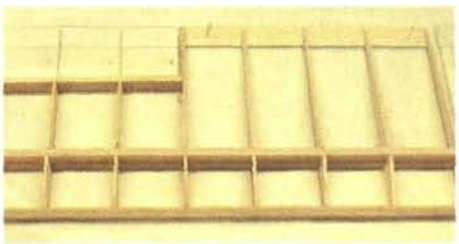
EACH CUT: 25 points.

REMAINING STREAMER: 1 point per foot.

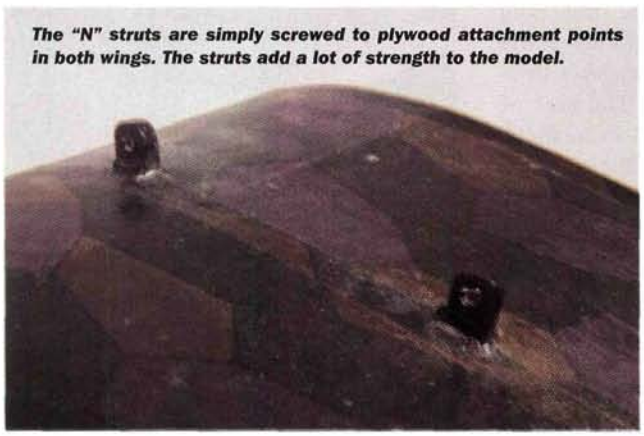
MIDAIR COLLISION: subtract 50 points from each participant.



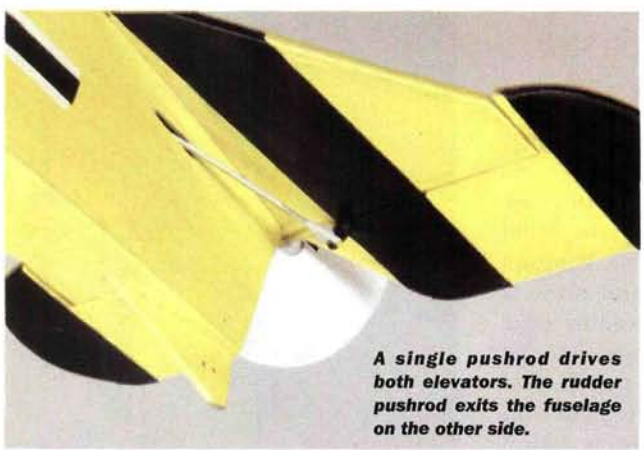
The bottom wing uses alignment dowels to key into the fuselage, and a single ¼-20 nylon bolt secures the wing in place.



Wing construction is very basic and goes quickly. The ailerons are built separately.



The "N" struts are simply screwed to plywood attachment points in both wings. The struts add a lot of strength to the model.



A single pushrod drives both elevators. The rudder pushrod exits the fuselage on the other side.

have pulled insane G with my model without it suffering any ill effects. The ribs are made of 1/16-inch balsa and the spars should be of fairly hard and straight balsa.

Do not delete the interplane struts, as they join the two wings and form a solid structure. To control the ailerons, I installed a microservo in the top wing with the arm facing up toward the top of the wing to drive a piece of 1/16-inch music wire. The wire pushrod runs between two bellcranks that drive the ailerons. Use an EZ connector to attach the servo to the pushrod, and thread the pushrod through the connector (in the center section) as you feed the pushrod through the wing. Once the pushrod is in and hooked up to the bellcranks, install the servo. The servo is mounted so that as you tighten the mounting screws, it forces the EZ connector to stay in the servo arm without a keeper. Once the control system is in, tighten the EZ connector onto the pushrod; you can then remove the servo to cover the wing. As an alternative, you could modify the wing to accommodate installing a microservo for each aileron.

There isn't much to do to build the tail feathers. The vertical fin is made out of soft 1/8-inch balsa sheet. Make sure that the wood is straight. The stabilizer is made of various widths of 3/16-inch-thick balsa sticks. The stabilizer is then sanded flat, the edges are rounded, and the control surfaces are hinged using your favorite method.

• **Final assembly and covering.** Finalize your engine and muffler installation as required. Bend the cabane struts and trial-fit them to the fuselage. One secret for making the cabane struts a whole lot easier is to use solder connectors as strut fittings. Bolt the fitting to the wing, and insert the cabane strut (plugged into the plane) into it, and solder the fitting in place. Next, bolt on the rear strut, and hold the wing in its correct location

Here, the Fokker is framed up and ready for covering. Simple construction is evident here.

(longitudinally), making sure that the incidence is correct. When the incidence is set, solder the rear tab on. Now wrap the top of the auxiliary struts and the main strut with fine copper wire, solder them together, and you've finished.

You have many choices of covering material for the D-VII. You can use a heat-shrink material like MonoKote, or you can use silkspan, as I did. There are many colorful paint schemes from WW I, so let your imagination fly! Now, finish installing your radio system and balance the model. I was able to achieve the correct CG by shifting the receiver and battery pack. It's now time to fly and seek out adversaries.

CONCLUSION

Simple to build and fun to fly; what more could you ask for in a WW I model? Performance with the recommended 2-stroke engine is very good, and the plane has no bad habits. Everyone in my club who has built the Fokker D-VII really loves it. Why not build one and see for yourself?

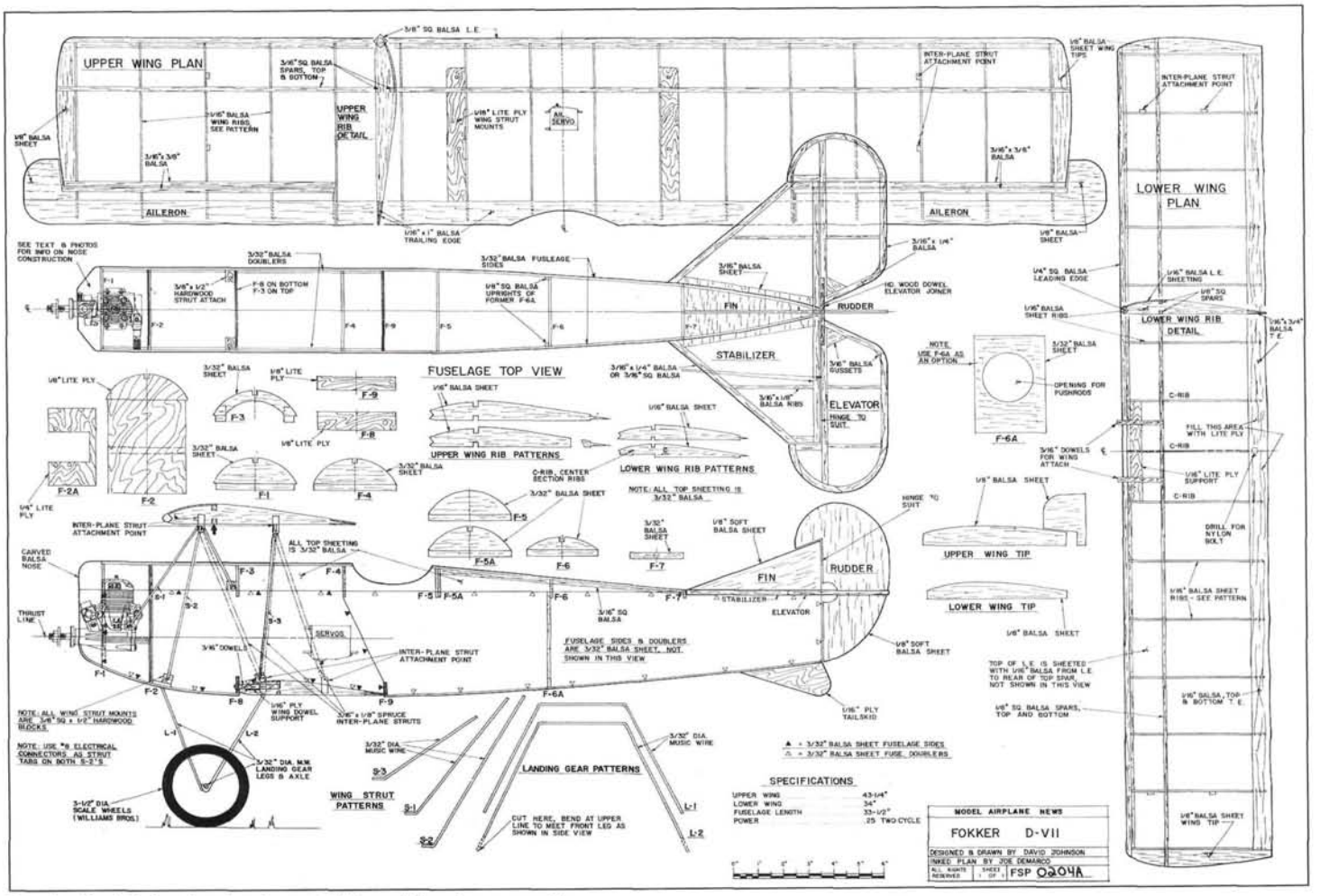
C.B. Tatone Inc. (510) 783-4868.

***O.S. Engines;** distributed by Great Planes Model Distributors (217) 398-6300; (800) 682-8948; osengines.com.*

FOKKER D-VII
FSP0204A

Designed by David Johnson, this small Fokker D-VII is big on performance. Designed around a .25 2-stroke engine and a C.B. Tatone in-cowl muffler, the model is built of balsa for quick and easy construction. The model is very maneuverable yet stable, and it makes a great combat model.

WS: 43.25 in.; L: 32.5 in.; engine: .25 2-stroke; 4 channels; 1 sheet; LD 2. **$14.95**



To order the full-size plan, turn to page 154, or visit rcstore.com online.

Freestyle Aerobatics

Flight groups

by Quique Somenzini

In the July 2003 issue, I talked about basic 3D aerobatic aircraft and radio program setup. This time, I continue that discussion.

No two people fly in exactly the same way, so transmitter program setups vary from pilot to pilot. Everyone has his own favorite "feel" when it comes to airplane setups, so there really is no single right way to set your model up for 3D competition. In this article, I offer the setups that I have found best for performing all the Aresti and freestyle maneuvers.

Today's high-end radios can help your flying a lot. Top fliers use the best radios because they need them for the top-level flying we expect of them! During many years of competition, I have found that flying consistently is the most difficult skill to acquire and also that it's the key ingredient to winning. Every flight and every maneuver you execute must be the best you can do. High-end radios help us with this. They offer a substantial advantage over standard radios, and almost everyone in aerobatic competition uses them.

SETUP DIFFERENCES

Today's aerobatic airplanes are capable of flying a wide range of maneuvers, and all of which are flown at different airspeeds. Because of this, not every maneuver requires the same rate, expo, or mixing settings. Let's take hovering and rolling circles, for example. With the same control settings, it would be very difficult to fly both maneuvers consistently well. You have to set your model up for each individual maneuver and then switch the settings to do each one.

Basically, you could do every maneuver while having full deflection (more than 45 degrees) on all controls, but this would result in some maneuvers being over-controlled, and that would obviously affect the consistency of your flying. You just can't do a good snap roll with the same control throws as you use for a "waterfall." You need a 150-percent rate on all three controls (ailerons, rudder and elevator) to do the waterfall, but a nice snap roll requires around 90 percent deflection for ailerons, 30 percent for elevator and 40 to 50 percent for rudder. It is nearly impossible to set this many control rates using only your thumbs. Proper radio programming is crucial to achieving top-level, consistent performance.

THE BASIC GROUPS

I arrange the various aerobatic maneuvers into groups, and then I assign each group a flight-mode setting.

The basic aerobatic maneuver groups are:

- General flight
- Spins
- Snaps
- Rolling circles
- 3D

I assign a particular flight-mode switch to each group. By doing this, I need only flip one switch to change all the rate and exponential settings that are specific to a group of maneuvers. I can also fine-tune group program adjustments without affecting the settings in other groups.

General flight (GF). My GF group includes all the maneuvers that are not included in the

Entering the various Rate and Expo values is easy with JR's 10X programmable transmitter.

Flight Mode programming helps to organize your model's setups and to maximize your aerobatic flight performance.

PHOTOS BY JOHN RIEO

other groups, with the exception of stall turns. The GF mode contains the control settings that will allow me to best perform maneuvers such as rolls, point rolls, loops, corners, vertical lines, 45-degree lines, landings and takeoffs. I've set all the rates and exponential settings so that I can perform these maneuvers smoothly. The amount of rates and exponential adjustment for the GF group can vary quite a bit for different types of airplanes. As a rule, I use the minimum amount of elevator needed to fly the various maneuvers smoothly. The 135-degree corners require the highest elevator rate, so it sets the highest rate amount for the entire group. Using minimum elevator rates to do maneuvers means that you need less exponential, and I think this is the way to go!

Depending on the number of setups, you can assign flight modes either to a dual-rate switch or to the large mix switch on the transmitter's top right.

I use whichever aileron-rate setting I need to keep the roll's rotation rate constant at the top of a vertical line. For example: when flying a 3-roll vertical line, I want the last roll to be at the same rate of rotation as it was for the first one, even though the airplane loses airspeed during the climb. You must have the extra aileron rate setting to keep the rotation rate constant. Finding out what this extra amount is takes time and practice.

I like a good rudder response, so my rudder-rate setting is probably above the average. I fly Mode I, so I control the rudder and elevator with my left thumb. When I roll the airplane horizontally, I use elevator and rudder inputs to keep it in a level, horizontal line. I try to set it so that thumb travel up and down and right and left is the same. A diagonal stick-travel pattern makes it easier for me to perform the maneuver.

The general flight-rate settings for my Yak-54 TOC are:

RATE		EXPO	
Elevator	19%	Elevator	35%
Rudder	80%	Rudder	20%
Ailerons	65%	Ailerons	40%

EXPONENTIAL (EXPO) CONTROL

This is also a great feature, but using too much expo softens the feel around the neutral stick position to a point at which your control is affected. I generally use as much exponential as I can without affecting my flight precision. Again, you need to practice and experiment to find the correct amount.

PROGRAMMABLE MIXING

This is another important radio feature for maximizing your airplane's performance. In general, I try to keep electronic mixing to a minimum, but in some cases, I have to use it. The most popular programming mixes are rudder to elevator, rudder to aileron and throttle to elevator. In the first two cases, the mixing amounts are adjusted to correct for any pitch or roll coupling that occurs during rudder input—usually while flying in knife-edge. The best type of mixing for this is multipoint, which will allow you to adjust the amount of mix from point to point over the full range of rudder movement for both left and right deflection. When adjusted correctly, the mixing function will allow the airplane to fly through a knife-edge loop using only rudder input; elevator correction inputs won't be required.

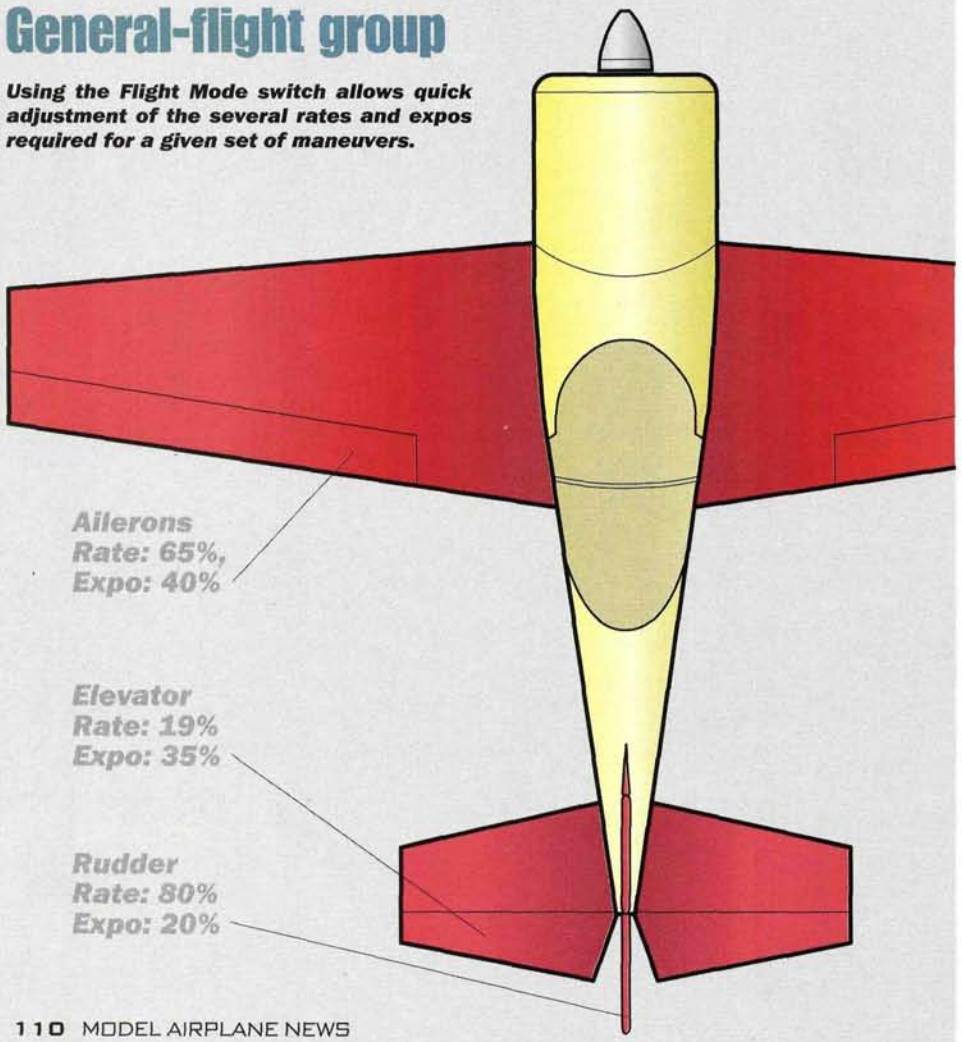
Use the "throttle to elevator" (T-E) mixing to keep long, vertical downlines perfectly straight. Of course, your airplane's CG location, wing incidence, etc., will also affect this. Most airplanes have a slight tendency to pull toward the canopy (upward) after a long downline. To check this, take your airplane very high (about 1,000 feet), and then reduce the throttle to idle, push it down into a perfect vertical downline and watch what the airplane does. Most airplanes will go perfectly straight and will show only a slight tendency to go to the canopy side, but some may tuck under toward the belly. In either case, use the T-E mixing to correct the downline. This mix is stick-position-activated, meaning that you program the throttle-stick position to set the mix. I normally set the T-E mix to be activated at one click above the full idle position. That last throttle click before full idle turns the mix on. As a rule, this mixing should never exceed 2 or 3 percent.

That's it for the general-flight group adjustments. Next time, I will cover all the rest of the flight groups and how to adjust the programs for each. ✈

JR; distributed by Horizon Hobby Inc. (800) 338-4639; horizonhobby.com.

General-flight group

Using the Flight Mode switch allows quick adjustment of the several rates and expos required for a given set of maneuvers.



POLK'S HOBBY **Tracker II**

by Bob Aberle

The ultimate in frequency freedom!

Imagine this: instead of waiting for your RC channel to become available, you simply scan the area to see which channels aren't in use, dial up one of those available channels, synchronize the signal on the receiver, and go fly. You can also scan for nearby channels to avoid possible interference. You aren't daydreaming: with the Polk's Hobby Tracker II radio system, this is a reality. This FM computer 8-channel RC system has a built-in frequency scanner, synthesized transmitter and receiver that can operate on any of the 50 airplane channels on the 72 to 73MHz band. It also has memory storage for up to 99 models. That's right—99! If that isn't enough, the Tracker II also offers a full array of special control features that rival any top-level RC system on the market.

THE SYSTEM

The basic Tracker II system comes with an 8-channel transmitter and the Seeker II receiver, a set of 900mAh Ni-Cd packs for both the transmitter and airborne equipment, a dual-output battery charger and one servo—because Polk's Hobby assumes that most modelers want to select specific servos for their applications. An airborne switch harness and a charging jack have a pushbutton switch that you can mount on the side of your plane's fuselage; this switch plugs into a special receiver port so you can change receiver frequencies without removing the plane's wing. The instruction manual is extremely thorough, well organized and easy to follow. The only surprise was the lack of a frequency flag; it would be nice to have a flag that you could easily change to whichever channel you decide to use.

MENU SYSTEM

The Tracker II's menu is divided into Track 1 and Track 2. When you call up Track 1, the radio doesn't transmit a signal, so you can't interfere with anyone. In Track 1, you can scan all 50 channels or just the channel that the transmitter is currently set on. You can also select a channel number and one of 99 memory positions (note: you can't input the model name). You can also copy data from one memory position to another, select wing mixes and Mode I or II, set a countdown timer, choose cross-trim positions, clear all data back to factory default, and most important, choose positive or negative FM deviation, so you can operate any FM RC receiver on the market.

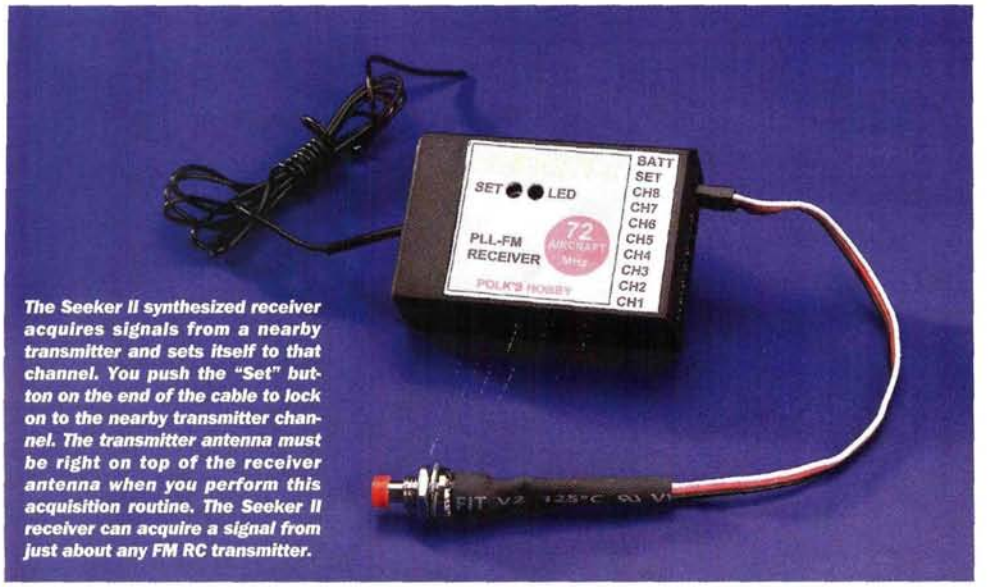
After you have input your choices or made your selections, you need to push "Model Data Save" (the last item on the menu) before you change to Track 2, the operating mode, or turn the power off. After you've done this, the Tracker II won't lose the information, even if you turn the power off or disconnect a battery pack. It also means that the transmitter doesn't have to go back to the factory for a periodic battery replacement.

Track 2 is the basic operating menu and contains all the control features we have learned to expect from a computer RC transmitter. A series of six pushbuttons allows you to select a portion of the Track 2 menu, then go on to select the specific channel function and input the exact data, such as control throw, that you require. Again, before you move on or turn off the power, you must hit the "Save" function to retain your selections.

SCANNER FUNCTION

Every time you turn on the power, the Tracker II first scans the frequency it was last set to. "Scanning" appears on the LED screen, and it is quickly followed by "RF OK—Wait," and then the normal display shows the operating channel number, corresponding frequency, model-memory number and the operating voltage.

In the Track 1 menu, you can switch the scanning function from manual to automatic, so the scanner will look at each aircraft RC



The Seeker II synthesized receiver acquires signals from a nearby transmitter and sets itself to that channel. You push the "Set" button on the end of the cable to lock on to the nearby transmitter channel. The transmitter antenna must be right on top of the receiver antenna when you perform this acquisition routine. The Seeker II receiver can acquire a signal from just about any FM RC transmitter.

channel and will flash and beep if that channel is in use or being interfered with. Just select a clear channel, and attach the frequency pin for that channel to the antenna to let everyone else know that your channel is in use.

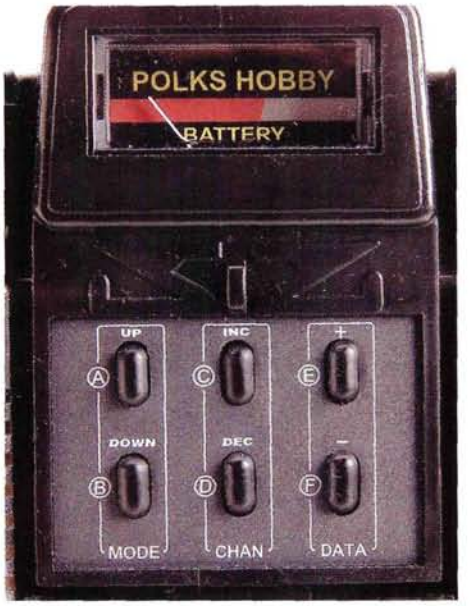
SEEKER FUNCTION

Besides being able to use any receiver with the Tracker II transmitter, you can use any FM transmitter to operate the Seeker II receiver. After it has locked on, the Seeker II will stay on that channel even after the power has been turned off and the battery has been removed. It's easy to set up; just plug the "Set" button cable into a port on the receiver, then hold down the "Set" button while you turn on the receiver power. The servo that's plugged into Channel 1 will begin to move back and forth. Turn on the transmitter with the antenna fully extended, and place the antenna within 2 to 6 inches of the Seeker II's antenna. When the servo stops moving in a few seconds, the receiver will be locked onto that transmitter frequency. To change to another transmitter frequency, just repeat the process. Keep in mind that when you change the receiver's frequency at the field, the transmitter is broadcasting a signal. Common sense must prevail in this situation!

SUMMARY

There is a lot to consider with this Tracker II RC system. You get a synthesized FM transmitter that can operate on all 50 RC aircraft channels and a built-in scanner that can tell you whether a channel is already in use. Because you can choose positive or negative FM deviation, you can operate any FM RC receiver with the Tracker II transmitter, and you can also use the Seeker II synthesized receiver with any other FM transmitter. This system also has 99-model memory and all the features you would expect from a computer radio. Best of all, this entire system (transmitter, receiver, battery charger and one servo) costs approximately $275—a small price to pay for never having to wait for a frequency pin! ✈

Polk's Hobby Inc. (973) 351-9800; polkshobby.com.



Six pushbutton switches input all of the control commands to the internal computer. You must always enter a "Save" command after making control-input changes for the transmitter to retain your choices.

SPECIFICATIONS

MODEL: Tracker II

MANUFACTURER: Polk's Hobby Inc.

TYPE: 8-channel FM synthesized computer radio

TRANSMITTER: 34.2 oz.; synthesized to operate on all 50 RC aircraft channels with both positive and negative FM deviation

RECEIVER: 8-channel FM Seeker II; 2¼x1 7/16x¾ in.; 1.5 oz.

SERVO: one 1.5-oz., GWS S03N standard w/10-inch cable

ACCESSORIES: switch harness with charging jack, 4-cell, 900mAh Ni-Cd airborne and transmitter battery packs, dual-output battery charger, a set of servo output arms and mounting hardware and an excellent instruction manual

PRICE: $275

FEATURES: an FM computer-radio-system transmitter with 99-model-memory positions and a built-in scanner that can broadcast on any channel; receiver can be used with any transmitter.

COMMENTS: at $275, the Tracker II system is a bargain—especially considering all the features this system offers and the frequency flexibility it affords.

HITS

- 50-channel synthesized (dial-up) operation.
- 99-model memory.
- Selectable positive or negative FM deviation.
- Built-in scanner.
- Synthesized receiver.

MISSES

- Doesn't allow user to name model-memory positions.
- No frequency flag provided.

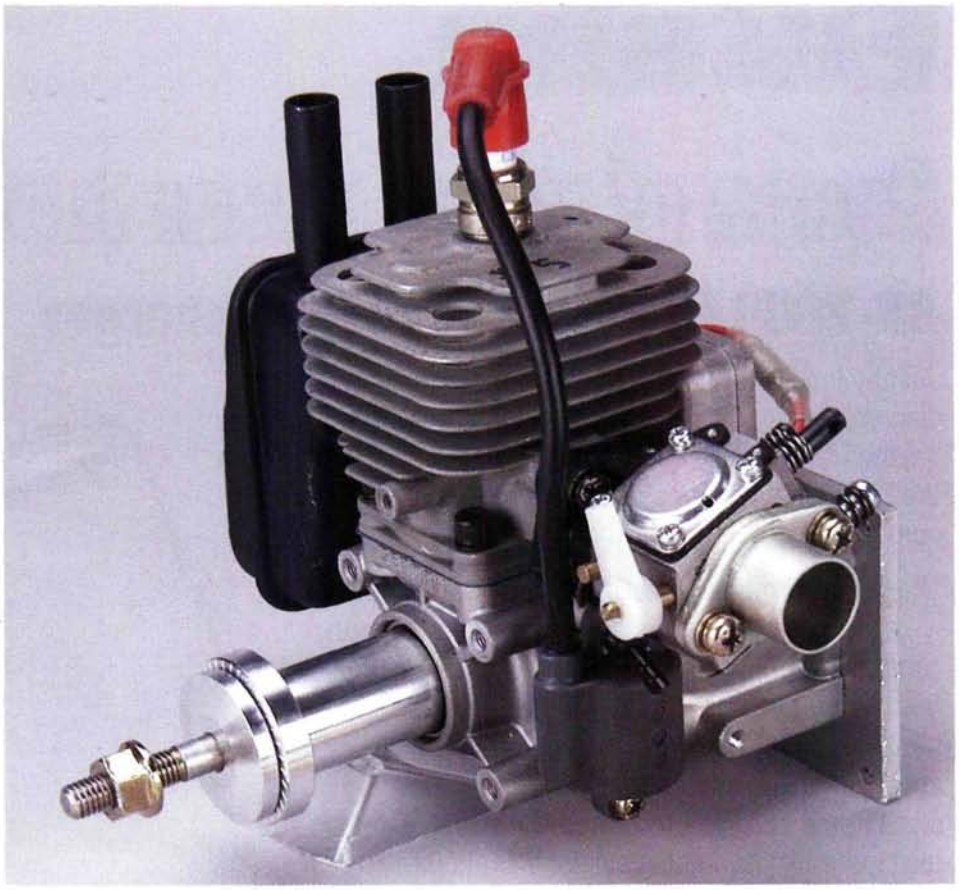
Turn on the transmitter power, and the built-in scanning receiver will first look to see whether your selected channel is clear before it goes on the air.

PRODUCT REVIEW

Zenoah G-26

Reinventing the standard in gas engines

by Bruce Smith

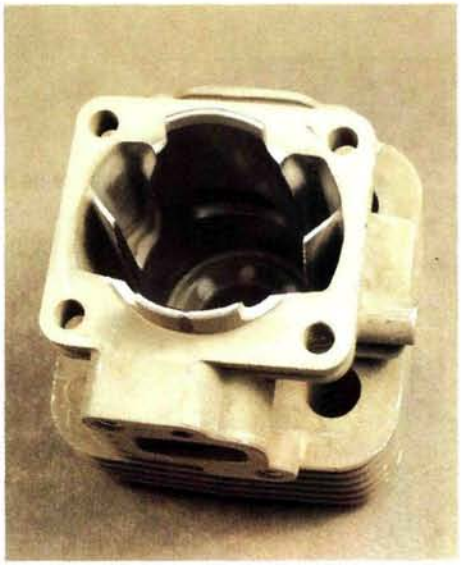


For modelers old and new, the name Zenoah is synonymous with high-quality, easy-to-operate, reasonably priced gasoline engines. Quite a few of us were introduced to the world of gas engines through the venerable, 1.4ci G-23—myself included. The G-23 was dependable, simple to mount and set up for flight and small enough not to intimidate newbie petrol pilots. With incarnations of the G-23 powering RC fixed-wing aircraft, helicopters, boats, 1/5-scale cars and foot scooters, I like to think that this "little" gas engine has proven itself to be the hardest-working gas engine in the business.

Komatsu Zenoah, a manufacturer of not only model aircraft engines but also ultralight aircraft and industrial engines, chose to retool the G-23 and create a more powerful and efficient small-displacement gas engine: the G-26. After a few cursory comparisons, it's clear that the 1.6ci G-26 isn't a mere upgrade of the G-23; its unique features set it apart from its predecessor. Airplane enthusiasts have the RC car sector to thank; the G-26 was primarily born from research and development for the 1/5-scale car market.

The crankcase halves are beautifully cast and weigh far less than I expected they would—a mere 7.1 ounces for the pair.

PHOTOS BY BRUCE SMITH



The G-26's cylinder is where much of the development over the G-23 took place. It features four transfer ports and weighs just 7.9 ounces.

FEATURES

• **Porting.** The most obvious difference between the G-26 and the G-23 lies in the new engine's appearance. The G-26 has an entirely redesigned crankcase and cylinder/head casting that increases the total number of boost ports from one to four. The manufacturer conservatively estimates an 800rpm increase over the G-23 when you use the same 16x8 APC prop, but owners of the better-breathing G-26 report even more impressive numbers than that. Test results suggest a more than 20-percent increase in usable power, and the new castings add only a 2-ounce weight penalty overall.

• **Ignition.** The Zenoah G-26 benefits from a Capacitor Discharge Ignition (CDI), or magneto, that's common to all Zenoah engines and doesn't require any additional electronics or a battery for spark. I find the simplicity of a magneto engine brilliant, although the required flywheel for the CDI is a little heavier. You can buy a lighter engine of equal displacement, but you will pay a premium. As with all things sophisticated and mechanized, when the weight goes down, the price goes up. The less you get, the more you pay—go figure! But for the money, you won't find a better-engineered,

PROP PERFORMANCE

Standard Zenoah muffler: dual exit (3/8-in. i.d.)

PROP	dB	RPM	THRUST IN POUNDS
APC 16x6	98	9,420	13.5
APC 16x8	97	9,150	13.25
Power Point 16x8	96	8,190	12
Master Airscrew Classic 16x10	97	8,610	12.5
Master Airscrew Scimitar 16x10	96	8,130	12.5
APC 17x6	96	9,060	14
APC 17x8	95	8,040	13.5
APC 18x6W	94	7,710	13.75
Zinger 18x6	95	7,260	12.25
Zinger 18x6-10	91	5,490	8
APC 18x8	95	7,290	11.5
Moki 18x8	95	7,860	12.5
Menz 18x10	91	5,610	10

Test conditions: temperature—70 deg. F; humidity—90 percent; barometer—30.12 in. Hg; fuel—92 octane/Klotz synthetic (40:1).

better-manufactured and longer-lasting engine than a Zenoah.

• **Carburetor block and linkage.** Another obvious reason for the G-26's power increase is its larger carb. The carb is also equipped with a choke, so it's easier to prime and start. A specially designed carburetor block and linkage arm come standard on the G-26, and similar blocks can be retrofitted to the G-23, G-38, G-45 and G-62; that makes it easier to install the throttle control. Those of you who have run gas engines that use Walbro pumper-type gas carburetors know that the linkages can be a challenge at times. Because of the industrial heritage of these engines, the angle at which the carburetor sits, coupled with the style of throttle plate found on the Walbro, doesn't lend itself easily to aircraft applications. The new carburetor-mounting block allows the carburetor to sit in a level position with the throttle butterfly at a right angle to the firewall. The addition of a linkage arm that's reminiscent of a nose-wheel steering arm puts the old problem to rest. Although the G-26 is shipped with the new block mounted (the original mounting block is included as well), you will have to do some minor tinkering to remove the industrial throttle-linkage plate and secure the new linkage arm. This isn't a big deal; the instructions included with the engine are clear and supported well with diagrams and photographs. The beauty of the Walbro carburetor is the integral fuel pump that allows you to position the fuel tank farther from the engine where it won't have an adverse effect on the center of gravity and flight performance.

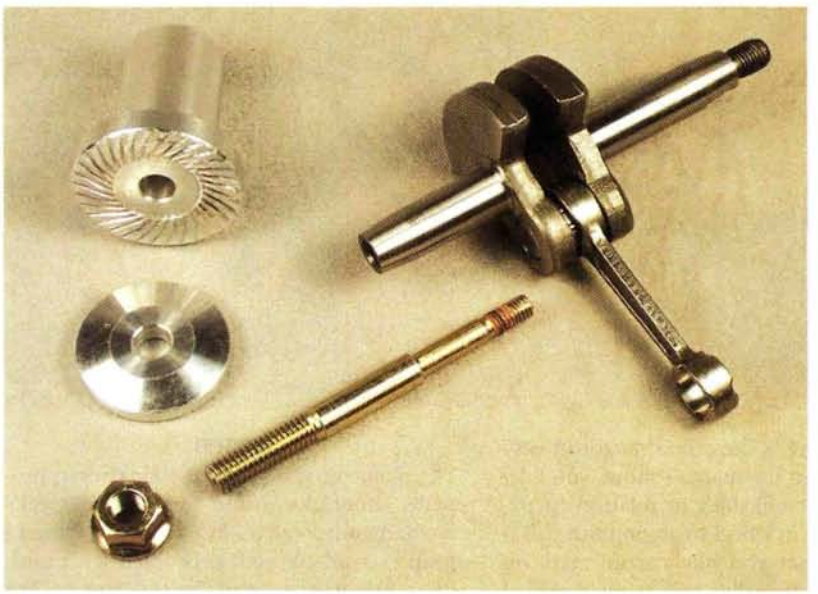
INSTALLING THE G-26

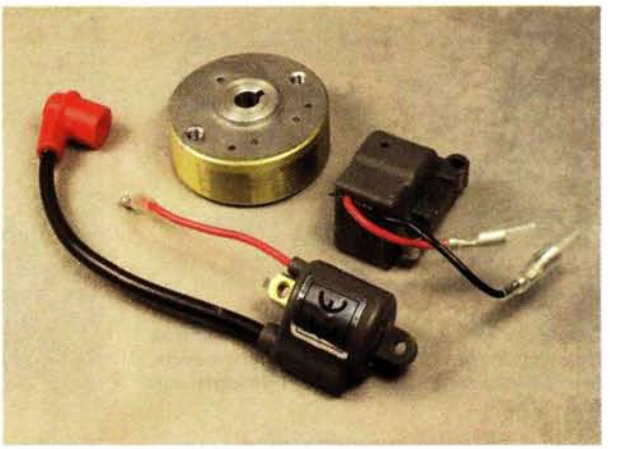
The G-26 arrives complete and ready to run with comprehensive instructions and a spark-plug wrench. The manual has a really cool flow-chart-style troubleshooting guide to assist you with any problems you may encounter—although with a G-26, they are unlikely.

The G-26 comes with a 1/4-inch-thick aluminum mounting plate that has the same bolt pattern as the G-23. The magneto on the G-26 is housed at the engine's rear (just like the G-23's), and the mounting plate covers all but a 1-inch hole in the center. You can add your own mounting plate, neoprene vibration isolation bushings and whatever else you prefer; the manual offers specific safety tips.

KILL SWITCH

Absent from the owners' manual are comprehensive instructions regarding the kill switch—a must on a gas engine. Although the manual's wiring schematic shows how and where to find the connection on the coil of the engine, there isn't any additional information that specifies the type of kill switch you must install. My choice is a prewired 10A, 125-VAC toggle switch; it's easy to find at the local auto-parts store. The compatible magneto lead connectors can be found at RadioShack, and they are simply crimped onto the toggle leads.





Left: the crankshaft of the G-26 is manufactured in halves with the main rod journal pressed into place between the two counterweight webs. The propeller shaft and hub are attached with a screw-in stud. Above: the flywheel is a stout chunk of cast aluminum and magnets that weighs 7.5 ounces; the rest of the CDI parts (two-part coil) add 4.7 ounces.

MUFFLER PERFORMANCE

PROP	dB	RPM	THRUST IN POUNDS
DAVIS #1 POWERMASTER MUFFLER: SINGLE EXIT (7/16-IN. I.D.)			
APC 17x6	95	8,910	14.25
APC 17x8	92	7,590	12.5
APC 18x6W	90	7,000	12
DAVIS #2 POWERMASTER MUFFLER: SINGLE EXIT (7/16-IN. I.D.)			
APC 17x6	96	8,790	13
APC 18x6W	93	7,170	12
SLIMLINE SMOKER PITTS MUFFLER: DUAL EXITS (1/2-IN. I.D.)			
APC 17x6	98	9,240	15
APC 18x6W	94	8,040	15.25
OPEN PORT (10X20MM)			
APC 17x6	113	9,780	17
APC 18x6W	112	8460	17.5

SPECIFICATIONS

ENGINE: Zenoah G-26

DISTRIBUTOR: Horizon Hobby Inc.

TYPE: 2-cycle gasoline, piston-valve type

DISPLACEMENT: 1.6ci (25.4cc)

BORE: 1.34 in. (34mm)

STROKE: 1.10 in. (28mm)

LENGTH: 7 1/16 in. overall; 5 7/16 in. to face of prop hub

HEIGHT: 6 7/8 in.

WIDTH: 7 1/4 in. (with velocity stack and standard muffler installed)

WEIGHT: 53 oz. (without muffler); 56.7 oz. (with stock muffler)

IGNITION TYPE: CDI (aka "magneto")

PROP SHAFT: stud-type, 8mm

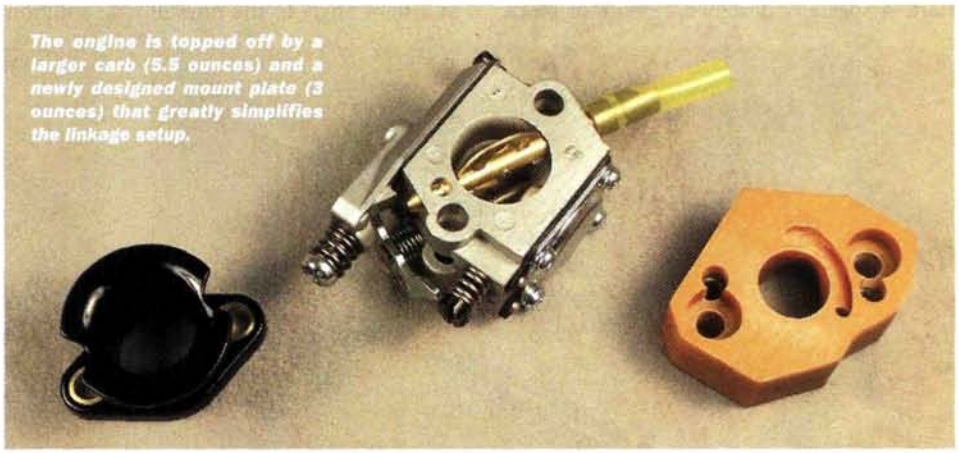
PRICE: $299.99

FEATURES: comes with canister muffler, spark plug, plug wrench and carb adaptor block; (stock block also included).

COMMENTS: the G-26 starts easily, has great power and is easy to fine-tune and install; it's a great engine for both new and experienced gas-engine enthusiasts!

The Zenoah instruction manual also omits a useful "rule of thumb" for all gas engines: keep the kill switch 8 to 12 inches away from the receiver, its on/off switch and its antenna, and always use a non-metal throttle pushrod. Ignition "noise" is a common cause of radio glitches on gas models; always perform comprehensive range tests with the engine running at idle and at full throttle. If there is a radio problem, it should make its presence known at this point; never fly your airplane if there is even the slightest fluctuation in your controls during the range tests.

The engine was tested with a variety of mufflers, including these two from Davis Model Products, the stock Zenoah muffler and a Pitts-style unit from Slimline.



The engine is topped off by a larger carb (5.5 ounces) and a newly designed mount plate (3 ounces) that greatly simplifies the linkage setup.

STARTUP AND OPERATION

All Zenoah engines are ready to gas and go; no break-in periods are required to get them to run dependably. Your engine is ready when you are. Although you don't need to bench-run the engine for break-in, performance will gradually improve as the engine is run in. The manual suggests that you run the G-26 with a fuel-to-oil ratio of 25:1 for an interim period, and then reduce the oil content to mix a ratio of 40:1. Use a high-grade, 2-cycle, "gas" engine oil and a high-octane, unleaded gasoline according to the manufacturer's specifications. The test engine already had an hour of run-in at the 25:1 ratio, so I did the instrumented testing at the prescribed 40:1. Klotz R/C Lube, Zenoah, Honda HP-2 and Amsoil Series 2000 synthetic motor oils are all great choices, and they are available at hobby, motorcycle and go-kart shops. I selected Klotz for these performance tests.

The beauty of the G-23 and G-26 is that although these engines use a magneto (which, on the larger-displacement engines, make them nearly impossible to hand-start without the risk of personal injury), these smaller-displacement engines are hand-flip friendly! Timing is the crucial factor in easy hand-starts, and the manual shows you how to orient the crankshaft in relation to the magnet on the flywheel to accomplish this. I recommend that you put a score mark on the top of the propeller hub at the specified location. To generate a spark with CDI, the flywheel magnet must rotate past the stationary coil quickly. I found that the propeller is roughly horizontal in relation to the crankshaft when it's in the proper position. This allows the propeller to quickly rotate a 1/4 turn before it hits the compression stroke at 12 o'clock.

PROPS

The diameter and pitch of your chosen propeller should be within the manufacturer's recommended range, but with the array of profiles available today, coupled with muffler selection, the static thrust of any engine can vary widely. I tested several propeller and muffler combinations to find the G-26's sweet spot. Remember, different size and thrust characteristics should be matched with the intended aircraft; be wise and follow the ARF or kit manufacturer's suggestions for engine displacement and weight.

For safety reasons, always balance your

Flight Performance

This test engine had about an hour of run time before the bench tests were performed. The engine was used to power the Hangar 9 Super Cub that was reviewed in the July 2003 issue of *Model Airplane News*.

The G-26 is very easy to start; you just flip the ignition kill switch to the run position, close the throttle and close the choke. Flip the prop over several times until the engine gives a bark or cough to indicate it has sufficient prime to start. Open the choke and advance the throttle to about ⅛ open. The G-26 will usually come to life on the third or fourth flip. Let the engine idle for a minute or two to come up to operating temperature, and you'll be good to go. If you prefer to use an electric starter, starting the engine is even easier, and you don't need to use the choke.

Turning an 18x8 Zinger prop, the G-26 easily powers the 100-inch Super Cub, and it will lift off at ⅔ throttle. Its throttle response is typical of a gas engine with a slight burble at the point where the carb switches over from the low-end to the high-end needle valves. At full throttle, the engine produces much more thrust than is necessary for the Super Cub, and you can fly all day long at ½ throttle. During landing, ¼ throttle provides a good power setting until you are ready to flare; then full idle is in order. In a go-around situation, the engine transitions nicely from idle back to full power.

If you are new to gas engines and want a user-friendly powerplant to cut your teeth on or if you want an easy drop-in power increase for your G-23-powered model, the G-26 is an excellent choice. After all, it is a Zenoah!

propellers! Don't ever assume that any wood, composite, nylon, or carbon propeller (yes, even one of those expensive European jobs) is balanced. Even the most miniscule variance in propeller balance can produce a potentially disastrous vibration—especially in larger-diameter propellers. The best-balanced gas engines can shake the life out of an airframe, and an out-of-balance propeller only aggravates the condition. Wooden propellers should be checked for balance periodically, as temperature and humidity changes can throw them out of balance; don't expect that because a wooden prop has been balanced once, it will stay that way.

TEST RESULTS

To evaluate the G-26, I tested it with several propellers and mufflers, including the stock Zenoah, a Slimline Pitts, and two canister-style SoundMaster mufflers from Davis Model Products. My test equipment consisted of a Glo-Bee digital tachometer, a RadioShack sound-level meter and my homegrown thrust bench. The test results list the thrust measured in pounds, decibels and rpm for each propeller with the stock Zenoah muffler. After I had determined which propellers performed the best with the standard muffler, I ran them with several other mufflers.

On test day, the air was cool and heavy with humidity. The G-26 was easy to start following a good prime. Go for the "pop" with the choke closed, and then open the choke fully and give it a good flip. I started off with the 16x6 APC; on the stock muffler, 9,420rpm at 98dB and 13.5 pounds of thrust was very encouraging—a substantial increase in output over the G-23.

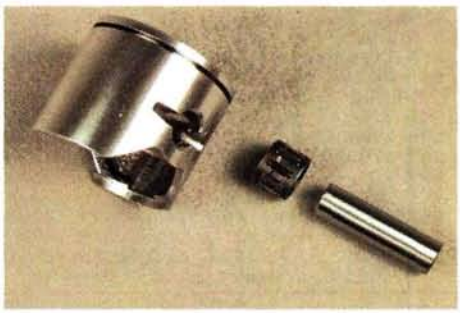
I have always been a proponent of finding the best propeller match that balances thrust, rpm and noise and shying away from high revving. Typically, higher rpm and the increased induction, exhaust and propeller speeds that accompany it amount to more noise but not necessarily more performance. The key is to find the best thrust output; it (as opposed to rpm) is the key to performance!

The Zenoah G-26 runs extremely dependably with crisp transition and smooth idle—albeit on the fast side—with great high-speed smoothness. The only time the motor quit on me was while it was turning the Menz 18x10 (for practical purposes, I'd call that the "wall"). After a minute of hard work pulling the big lumber, it simply said, "Forget it." I changed to the next prop within its performance range, and the G-26 fired right back up and pulled happily once again.

Normally, I don't bother to test an engine with an open exhaust because I feel that running it without a muffler is unrealistic for "practical" purposes. Who would be able to run an engine open port (or want to for that matter)? It's *loud*! But after I had the results, I realized the importance of the data in determining the overall fortitude of the engine; I'd certainly call the results revealing. Thrust gains with the exhaust unencumbered drives home the point that this engine has tremendous potential—17½ pounds of thrust!

Gas engines have traditionally cost less to operate than large-bore glow engines. A nitro engine with displacement equal to the G-26 (1.6ci) could burn as much as an ounce per minute (or more) of costly methanol-based fuel. Even among gas engines, I think you will find the miserly consumption of the G-26 remarkable for an engine of its size. The rock-stock G-26 took 14 minutes to burn 16 ounces of gas while turning an APC 18x6W at 8,040rpm and producing 15¼ pounds of thrust.

Although the G-26 is a great match for the Hangar 9 100-inch Piper Super Cub (reviewed in the July 2003 issue of *Model Airplane News*), a smaller span, more aerobatic aircraft would also be a good choice for this engine. The G-26 would be a potent addition to any 1.20-size sport or aerobatic airplane that could handle the engine's weight and torque. The G-26's muscle, great throttle response and its pumper carburetor make it an excellent match for 3D and giant fun-fly aircraft, especially with the APC 18x6W, which was developed for that market. Overall, I was really impressed with the power, the price and the ease of operation that the Zenoah G-26 offers!



The cast-aluminum piston, hardened-steel wristpin and needle-bearing race weigh only 1.3 ounces.

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Glow to electric – converting a .60-size Stuka

Although I thoroughly enjoy building new models, it gives me just as much pleasure to convert glow-powered planes to electric. Most recently, I converted the Great Planes Stuka. The Stuka is an excellent subject for conversion; it's big, light and available in an almost-ready-to-fly (ARF) version. It's also a plane that you don't see at the field every day, and that definitely adds to its allure.

The Stuka comes fully framed with balsa and ply, which makes it not only light but also easy to repair with conventional materials. It comes covered with MonoKote that can be easily matched, if necessary.

THE PLAN

In glow form, the Stuka should weigh about 8 pounds ready-to-fly (RTF), and as an electric, the batteries account for the only real difference in weight. Because the Stuka is such a big plane (770 square inches of wing area), I knew I would need 20 or more cells. Given that, I estimated the all-up weight to be around 10 to 10.5 pounds and the wing loading to be 29.9 to 31.4 ounces per square foot. This fell right into the accepted range for warbirds.

Now, what about power? Because I wanted the Stuka to be capable of standard warbird aerobatic maneuvers, I needed a power system that could produce 788 watts (75x10=787.5; i.e., watts per pound required for desired aerobatics multiplied by the weight of the plane). By limiting myself to 20 cells, I concluded that a system that drew 40 amps would provide me with the 800 watts I needed.

THE POWER SYSTEM

My first step was to discuss my needs with Pete Peterson of Model Electronics Corp (MEC), maker of the Solderless Power Tubes (SPT) and dealer in a variety of electric flight equipment. I explained that I wanted a complete "plug 'n' play" package, and after asking just a few questions about the project, Pete recommended a power system that was perfect for what I had planned.

When the box arrived from Pete, I really got excited. It included a Mega brushless/sensor-less 22-45-3 motor with an MEC 3:1 gearbox; 20 Panasonic 3000mAh NiMH zapped cells (encased in two 10-cell SPTs) were ready to be hooked up in series. To round out the power system, I chose an APC-E 17x10 prop and the new 80A speed control from Castle Creations.

Last, I sat down and punched all the particulars into my ElectriCalc program to verify that all my calculations would work. Everything looked good!

THE STUKA KIT

This is a gorgeous kit right out of the box. The covering has been applied well, and the finish on the fiberglass wheel pants and cowl is great. The photo-illustrated instructions are excellent, and the included hardware was more than adequate. This is one of the nicest ARFs I've assembled. The wing sections fit well and the wheel pants were perfectly cut to fit over the gull joint in the wing. To say this kit impressed me would be an understatement!

THE CHANGES

Because I didn't want to cut into the covering to make any structural changes, I concentrated on the model's interior and radio equipment. To mount the motor, I used the Super Universal Mount (SUM) from Cambria Tool & Machine (featured in our December 2003 issue). It's the most versatile mounting system I've found to

PHOTOS BY GREG GIMLICK

date, and the motor can be mounted directly to the mounting box provided with the kit. By adding spacers, I mounted the motor to the provided mounting surface and fit the cowl perfectly.

I drilled a large hole in the bottom of the box to allow cooling air into the fuselage, and I plan to add a small scoop to more effectively direct the air from the large cowl scoop to the battery area. Although the equipment doesn't get excessively hot, it's always a good idea to allow as much cool air through as possible—especially if you live in a warm climate. I then cut an exit hole in the bottom of the fuselage behind the wing; that opening also allows access to the radio battery pack. Because the Stuka uses six servos, I didn't use a BEC device.

Next, I built the battery platform for the motor pack directly into the top of the fuselage using a ¼-inch slab of balsa backed with 3/32-inch ply and the existing formers for the base. The wing must be removed to access the pack, but I cut a small hole in the bottom of the forward fuselage for access to the plug, so I can easily arm and disarm the system without removing the wing. Because the battery pack is actually under the platform when the plane is upright, I attached it with hook-and-loop fastener, both on the platform and wrapped around the battery itself. The pack's forward end is further supported by a cross-member glued to the former. There is plenty of room to adjust the center of gravity (CG) by sliding the pack fore or aft.

The only other change I made was to install small, Hitec HS-85BB servos in place of the standard servos designated in the instructions; this saved several ounces with little or no loss of torque. With everything in place, I headed off to the scales; my converted Stuka weighed in at just 152 ounces! That meant that I had achieved a wing loading of only 28.4 ounces per square foot!

THE MOMENT OF TRUTH

Test flights immediately proved that the Stuka conversion was a success. It's a pure joy to fly. Power is more than sufficient for a full range of WW II maneuvers—and then some. The Solderless Power Tubes handle the current and heat very well, and to check individual cells, it's simply a matter of uncapping them to dump them out. The CG as listed in the plans is fine, and the suggested control throws proved more than adequate without being scary. A stall is more of a

SPECIFICATIONS

NAME: Ju-87 Stuka

MANUFACTURER: Great Planes

TYPE: .60-size ARF warbird

WINGSPAN: 70 in.

WING AREA: 770 sq. in.

WEIGHT: 8 lb. (glow); 10.5 (electric RTF)

WING LOADING: 28.4 oz./sq. ft. (electric RTF)

MOTOR USED: brushless Mega 22-45-3 geared 3:1

BATTERY USED: 10 Panasonic 3000mAh NiMH cells

PROP USED: APC-E 17x10

ESC USED: Castle Creations 80A

AMP DRAW: 37

mush than a true stall, and recovery is merely a matter of relaxing the controls. This plane almost flies like a trainer with great aerobatic ability. A word of caution: watch the elevator authority at very low speeds without power. I had to increase the throw to slightly more than what was recommended.

CONCLUSION

This conversion was more successful than I had even hoped. The completed Stuka is lighter than I had planned, and its power/duration is excellent. Any flier with mid-wing proficiency should be able to fly this plane. Until you get a good feel for the flaps, it's a good idea to exercise some caution. The large, split flaps are very effective, so you should try them at altitude before using them on approach.

The Mega-motor system actually draws only 37 amps instead of the 40 I had projected, but I have excess power and the equipment runs cool. The Castle Creations speed control handles this setup with ease.

This project is definitely a winner, and it shows, once again, that electrics have arrived. With "plug 'n' play" systems available from knowledgeable vendors, anyone can be successful the first time out.

Now, it's time to go looking for the next conversion project; see you at the field!

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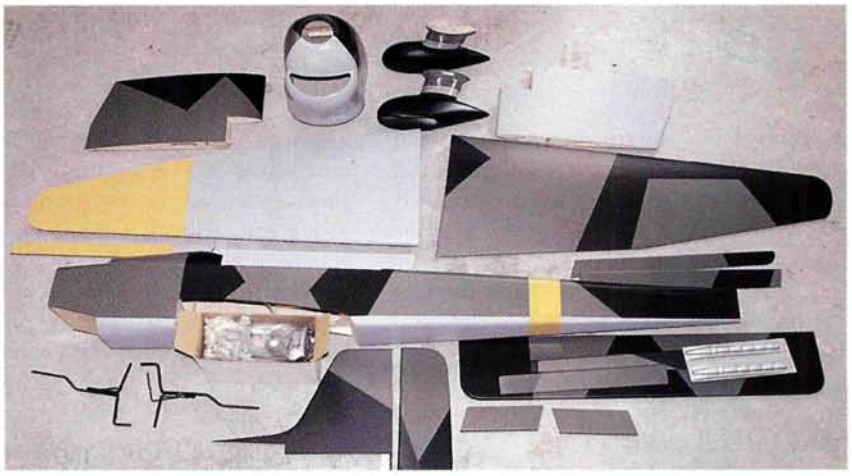

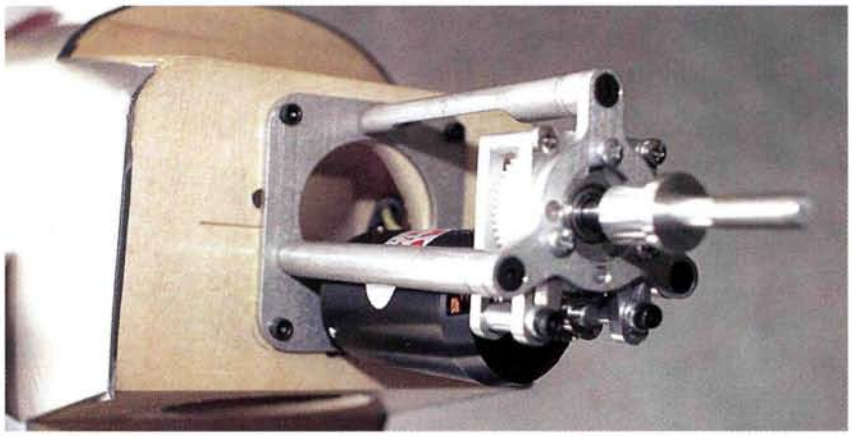

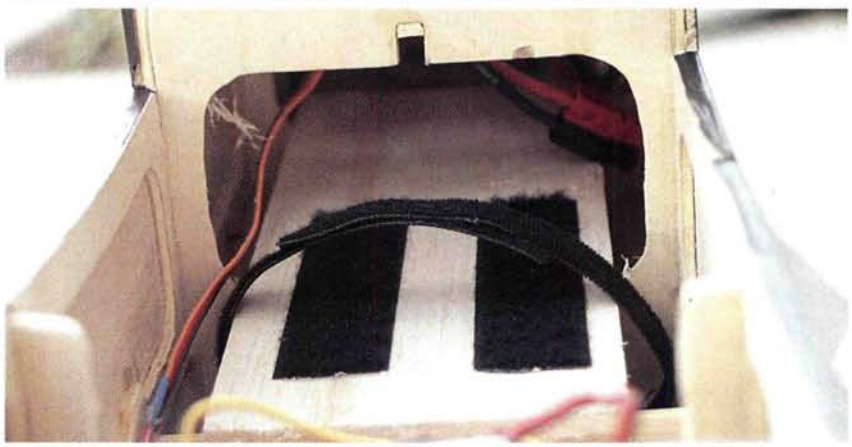

Top right: here's what the Great Planes Stuka looks like as it comes out of the box. Second from top: to power my electric Stuka, I installed a Mega motor with MEC gearbox, Solderless Power Tubes from MEC, a Castle Creations 80A speed control and an APC-E prop (not shown). Second from bottom: here's a close-up view of the motor installation using the SUM mount; it was a fairly simple substitution. Bottom right: the cavernous battery compartment can handle a variety of battery-pack configurations.

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Left: the winning model was designed by students from San Diego State University. They used carbon-fiber and foam construction. It was powered by a geared Graupner 3300-5 brushed motor and 18 CP-2400 Ni-Cd cells. Above: two requirements are that the airplane must fit within the 4x2x1-foot box, and it must be assembled quickly by no more than three people. Here, members of the University of Texas, Austin, team race against the clock to assemble their plane. Bottom: the third-place winner was "Galileo IV" flown by the team from La Sapienza, Rome, Italy. It was of carbon-fiber and foam construction with a twin tail to compensate for the short fuselage.

Design/Build/Fly Competition

For the last seven years, the American Institute of Aeronautics and Astronautics (AIAA), Cessna Aircraft and the Office of Naval Research have sponsored a university-student competition in the design, building and flying of a radio controlled model aircraft. Each participating university forms a team of eight to 15 engineering students who write a design report, build an aircraft to accomplish the mission parameters set for that year and then compete in a flight competition. The teams earn points for each phase of the project. Cash prizes are $2,500 for first place, $1,500 for second place and $1,000 for third place. The 2003 competition was held in Ridgely, MD.

Greg Page and Chris Bovais, from the Naval Research Lab (NRL), do a fine job of running the competition. Many volunteers assist in all phases of the competition, including the development of criteria, grading of reports, safety inspections and flight competition.

DESIGN OBJECTIVES

Each year, the design objectives and the flight missions are changed to encourage innovation. This year, the objective was to design an aircraft that could be packed in a 4x2x1-foot box, assembled quickly by no more than three team members and then flown in two of three specified UAV (unmanned aerial vehicle) type missions: Missile Electronic Warfare (EW) Decoy, Sensor Deployment and Communications Repeater.

DESIGN REQUIREMENTS

1. Any configuration is allowed except rotary wing or lighter than air.

2. It must be an electric-powered, prop-driven aircraft. The number of motors is free, but only brushed motors from Graupner or AstroFlight may be used.

3. Maximum battery-pack weight is 5 pounds made from commercially available Ni-Cds.

4. Pilot and aircraft must be AMA legal.

5. Maximum motor current is limited to 40 amps by a fuse.

6. All aircraft must undergo a rigorous safety inspection, and entrants must provide proof of prior flight (video or photo).

MISSION REQUIREMENTS

Each team selects two of three missions to fly. The object is to fly as many sorties as possible in a 10-minute period while meeting all mission requirements. The flight score is determined by the missions selected (varying difficulty) and the number of sorties accomplished. All takeoffs must be accomplished within 120 feet.

- **Missile Decoy.** The aircraft must take off from the runway, complete four laps and land on the runway. The payload is a 5-pound, 12x6x6-inch box. The aircraft must also externally carry a simulated cylindrical antenna made of 6-inch-diameter PVC pipe.

- **Sensor Deployment.** The aircraft must take off, fly two laps and then land. A 5-pound payload must be dropped to the runway by the aircraft; then it must take off and fly another two laps.

- **Communications Repeater.** The aircraft must take off, complete four laps and land while carrying the same 5-pound payload.

COMPETITION RESULTS

Thirty-three teams from universities in the United States, Canada, Turkey and Italy participated. Most of the entries had wingspans of between 6 and 8 feet and used 60- to 90-size electric motors. The final score for each team was a combination of their flight results, the score on a written report and a "Rated Aircraft Cost," which is a measure of the complexity and difficulty of building the aircraft.

THE TOP THREE TEAMS

1. San Diego State University
2. California Polytechnic State University
3. La Sapienza, Rome, Italy

FINAL THOUGHTS

The Design/Build/Fly Competition is an excellent learning experience for engineering students; it combines theory and hands-on work to produce some truly innovative designs. The flying competition for 2004 will be held this spring at Cessna in Wichita, KS; it will return to the East Coast in 2005.